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SELECTED

SWATERRESOURCES ABSTRACTS



VOLUME 14, NUMBER 7 APRIL 1, 1981

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 14, NUMBER 7 APRIL 1, 1981

W81-01001 -- W81-01203





The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the Water Resources Thesaurus. The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology U.S. Department of the Interior Washington, D.C. 20240

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

CHLORIDE IONS IN AQUEOUS SOLUTIONS, Bristol Univ. (England). H. H. Wills Physics Lab. S. Cummings, J. E. Enderby, G. W. Neilson, J. R. Newsome, and R. A. Howe. Nature, Vol 287, No 5784, p 714-716, October 23, 1980. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Aqueous solutions, *Chlorides, *Sodium chloride, *Electrolytes, *Calcium chloride, tithium chloride, Rubidium chloride, Nickel chloride, Barium chloride.

The isotopic substitution method was used to study the geometry of chloride ion coordination (hydra-tion) in aqueous solutions of the following counterions: lithium, sodium, rubidium, calcium, nickel, and barium. Salts composed of both C135 and C137 isotopes were dissolved in heavy water and their scattering lengths measured: C135 salts, 1.17 fm; C137 salts, 0.35 fm. Results indicated that chloride ion hydration is essentially independent of both cation and ionic strength with the exception of Ni(++). Therefore, counter-ion influences may be considered second-order, leading to a simplification in the theory of solutions. However, it is possible that highly concentrated solutions of transition metal ions may be exceptions to these findings. (Cassar-FRC)

2. WATER CYCLE

2A. General

WATER RESOURCES OF BOULDER COUNTY,

Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 5B. W81-01031

MODELING THE RUNOFF PROCESS IN URBAN AREAS,

Purdue Univ., Lafayette. School of Civil Engineer-

J. W. Delleur, and S. A. Dendrou.

CRC Critical Reviews in Environmental Control, Vol 10, No 1, p 1-64, July, 1980. 18 Fig, 6 Tab, 204

Descriptors: *Urban runoff, *Model studies, *Urban drainage, *Storm runoff, Environmental effects, Rainfall-runoff relationships, Water pollution, Reviews, Evaluation, Distribution patterns, *Urban hydrology, Design storm

The major works critically reviewed pertain to the large, recent, specialized literature concerned with the study of storm runoff and its environmental effects. The effort is made at producing a synthesis of the state-of-the-art in modeling urban runoff, with emphasis on identifying the limitations, current needs, and trends of future work. After a discussion of precipitation and its abstraction over urban areas, the models of physical processes are presented; those related to the quantity and quality (pollutants) are discussed separately. Also a dis-tinction is made between the lumped parameter models and the distributed parameter models. The most important development in urban hydrology during the last decade has been the development of sophisticated large-scale simulation models of storm drainage systems. Finally the economics of urban storm-drainage systems are addressed and conclusions and future trends are presented. W81-01153

2C. Snow, Ice, and Frost

RECONNAISSANCE SNOW SURVEY OF THE NATIONAL PETROLEUM RESERVE IN ALASKA, APRIL-MAY 1979,
Geological Survey, Anchorage, AK. Water Re-

Geological Survey, Anchorage, A.A. water Acsources Div.
W. J. Glude, and C. E. Sloan.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-225006,
Price codes: A02 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations
80-49, 1980. 13 p, 7 Fig, 1 Tab, 3 Ref.

Descriptors: *Snow surveys, *Evaluation, *Alaska, *Snow management, *Snowfall, Precipitation(Atmospheric), Sampling, Snow cover, Snowmelt, Water equivalent, Snowpacks, Avalanches, Remote sensing, *National Petroleum Reserve in Alaska.

Moderately low snowfall and an early and abrupt spring thaw resulted in removal of most of the snow cover from the National Petroleum Reserve in Alaska (NPRA) before the snow survey of April 30 through May 2, 1979. Logistical problems and lack of snow permitted sampling at only seven sites. The average snow depth (0.263 meter) was approximately 60% of that measured in the 1977 approximately 60% of that measured in the 1977 and 1978 surveys. Snow density in 1979 averaged 337 kilograms per cubic meter and water equivalent averaged 0.088 meter. These two values are about 110% and 70%, respectively, of values for those characteristics in 1977-78. The average temperature of 5-2. Celsius at the base of the snowpack was about 6 Celsius higher than in the previous surveys. Extensive recent slab avalanche activity was noted in the Brooks Range. (USGS) W81-01187

2D. Evaporation and Transpiration

PROGRAMS REVAP AND WEVAP FOR ESTI-MATING AREAL EVAPOTRANSPIRATION AND LAKE EVAPORATION FROM CLIMATO-LOGICAL OBSERVATIONS, National Hydrology Research Inst., Ottawa (On-

NHRI paper No 12, 1980. 56 p, 4 Fig, 1 Tab, 5 Ref, 3 App.

Descriptors: *Evapotranspiration, *Lake evapora-tion, *Climatic data, Data collections, *Computer models, Areal hydrology, Potential, Documenta-tion, Input, Air temperature, Dew point tempera-ture, Sunshine duration, Forecasting.

This report contains the necessary documentation for application of the computer programs REVAP and WEVAP. Estimates of areal evapotranspiration or lake evaporation for periods of 5 days to 1 month are made from routinely published records of air temperature, dew point temperature and sunshine duration. Both models are based on a sunstance duration. Both models are based on a complementary relationship between areal and potential evapotranspiration. Details of preparation of the input card deck as well as a sample output are discussed. Included in the appendices are the FOR-TRAN program listing for program REVAP and documentation of the comparable Hewlett-Packard HP-67 hand-held calculator program. (WATDOC)

WATER MOVEMENT THROUGH STANDS OF LODGEPOLE PINE FOREST IN WYOMING, Wyoming Univ., Laramie. Dept. of Botany. D. H. Knight, and T. J. Fahey.
Available from the National Technical Information Service, Springfield, VA 22161 as PBa1-152027, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, University of Wyoming Project Completion Report, November, 1980, 75 p, 11 Fig., 9 Tab, 92 Ref. OWRT-B-036-WYO(1), 14-34-0001-7202.

Descriptors: *Transpiration, Water loss, *Lodge-pole pine trees, *Forests, *Flow, Forecasting, Soil-water movement, Snowmelt, Phytometers, Rain-fall, Model studies, Weather, *Wyoming.

Various aspects of water movement through lod-gepole pine forest were studied. The results, pre-sented in 3 separate chapters, can be summarized as follows: (1) stands with very different tree density tollows: (1) stands with very different tree density and biomass may have very similar leaf area indices (6.5 and 6.7) and clear day transpiration rates (3.3 and 3.4 mm day super -1, measured with whole-tree potometers); (2) whole-tree potometers can be used for estimating short-term transpiration when leaf water potential is not limiting leaf conductance; (3) individual tree basal area and maximum standard standa mum observed 24-hr potometer uptake were highly correlated in the stands studied, with the largest trees (20-26 cm dbh) transpiring 40-44 liters largest trees (20-26 cm doh) transpiring 40-44 liters on clear days in early summer; (4) on overcast days potometer uptake was reduced by 30-44%; during rainy periods uptake was reduced to nearly zero; (5) predicted outflow, using a computer simulation model developed during this study, appeared to be more sensitive to variation in soil waterholding capacity than to stand leaf area, but the combined effects of forest LAI on water uptake during snow-melt, timing and duration of snowmelt, and soil water drawdown in summer and fall resulted in significant effects on predicted outflow; and (6) overnight frost in the spring reduced leaf conductance the following day, and midday leaf conductance was highly correlated with the mean temperature of subfreezing nights.

2E. Streamflow and Runoff

PREDICTING THE EFFECTS OF STORM SURGES AND ABNORMAL RIVER FLOW ON FLOODING AND WATER MOVEMENT IN MOBILE BAY, ALABAMA, Alabama Univ. University

G. C. April, and D. C. Raney G. C. Aprii, and D. C. Kaney. In: Estuarine and Wetland Processes, P. Hamilton and K. B. MacDonald (Eds.), Plenum Publishing Corp., New York, NY, 1980. p 217-245. 10 Fig, 6 Tab, 9 Ref, 1 Append. OWRT-A-061-ALA(3).

Descriptors: *Model studies, Mathematical models, Descriptors: Model studies, Mathematical models, Storm surge, *Flooding. Water spreading, *Alabama, Experimental models, Climatic data, Mathematical studies, Computer models, Numerical analysis, Probability, Statistical methods, Storms, Hurricanes, Tropical cyclones, Storm water, Weather, Floodwater, Flood waves, Bays, *Mobile Bay(AL).

Recent numerical modeling activities of the Mobile Bay system under severe conditions were dis-cussed. Results were presented in terms of changes that occur in water elevation and movement, and, in salinity distribution patterns when the Bay is that occur in water elevation and movement, and, in salinity distribution patterns when the Bay is subjected to river flooding inflows and storm surges. A river flood stage of 7000 cubic meters per second results in water behavior in the northern and central Bay portions that is totally governed by the fresh water inflow. A salinity level of five parts-per thousand (ppt) is restricted to the lower Bay region at a point 15 kilometers from the Main Pass. Usual salinity values under normal conditions in this area range from 15-20 ppt. A critical river flow rate of 8500 cubic meters per second was identified, at or above which saline water intrusion in the lower Bay becomes stabilized at 10 ppt on a line 6 kilometers north of the Main Pass. Conversely, large amounts of saline water enter the Bay under the storm surge conditions studied. Conditions used in the modeling exercise were typical of those caused by Hurricane Camille in 1969. In both cases, the model results were representative of Bay behavior. (Zielinski-IPA)

AERIAL INFRARED PHOTOGRAPHY FOR FLOOD PLAIN INVESTIGATIONS, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 7B. W81-01055

QUALITY OF WATER IN THE BLACK RIVER NEAR DUNN, NORTH CAROLINA, AND GROUND-WATER LEVELS ADJACENT TO THE RIVER PRIOR TO CHANNEL EXCAVA-

Field 2-WATER CYCLE

Group 2E-Streamflow and Runoff

Geological Survey, Raleigh, NC. Water Resources

For primary bibliographic entry see Field 6A. W81-01193

FLOOD OF JUNE 18, 1978, ON HONEY CREEK TRIBUTARY AT THORNVILLE, OHIO,

Geological Survey, Columbus, OH. Water Resources Div.

E. E. Webber, and R. I. Mayo.

Geological Survey Open-File Report 80-16 (WRI), 1980. 7 p, 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Floods, *Ohio, *Rainfall-runoff relationships, *Streams, *Flash floods, Flood damage, Flood peak, Flood frequency, Flood recurrence interval, *Honey Creek tributary(OH), Thornville(OH).

A high-intensity summer rain estimated at 8 inches A high-intensity summer rain estimated at 8 inches in 2 hours caused flooding on a small stream near Thornville, Ohio, destroying a culvert and highway fill on State Highway 188. Computation of peak discharges of 3,250 cubic feet per second above and 4,050 cubic feet per second below the culvert indicates a greater than 100-year flood. (USGS) W81-01194

DEVELOPMENT OF A MODEL FOR ESTI-MATING THE EXTENT OF RIVER FLOOD-ING WITH SATELLITE AND IN SITU DATA, Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering. For primary bibliographic entry see Field 7B. W81-01203

2F. Groundwater

MODEL EVALUATION OF THE HYDROGEO-LOGY OF THE MORRIS BRIDGE WELL FIELD AND VICINITY IN WEST-CENTRAL FLORIDA,

Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 6A. W81-01027

GROUND-WATER APPRAISAL OF THE FISH-KILL-BEACON AREA, DUTCHESS COUNTY, NEW YORK,

Geological Survey, Albany, NY. Water Resources

D. S. Snavely.

D. S. Snavely.

Available from the OFSS, USGS Box 25425, Fed.

Ctr., Denver, CO 80225, Price: \$7.50 in paper copy, \$5.00 in microfiche. Geological Survey Open-File Report 80-437 (WRI), 1980. 14 p, 1 Fig, 3 Plates, 3 Tab, 4 Ref.

Descriptors: *Groundwater resources, *Aquifer Descriptors: "Groundwater resources, "Aquiter exspecting," Groundwater availability, "New York, Geology, Water wells, Well data, Water yield, Hydrologic budget, Groundwater recharge, Discharge(Water), Water storage, Water utilization, Withdrawal, Groundwater potential, Chemical analysis, "Dutchess County(NY).

The most productive aquifers in the Fishkill-Beacon area, Dutchess County, N.Y., are the sand and gravel beds in the northeast corner of the area and along the valleys of Fishkill and Clove Creeks. The average yield of these aquifers to wells is 190 calvini (eallons per minte). The most productions of the production Inc average yield of these aquiters to wells is 170 gal/min (gallons per minute). The most productive bedrock aquifer is limestone, which yields an average of about 150 gal/min. Shale and granite each yield an average of less than 35 gal/min. About 4 billion gallons of available ground water is estimated to be in storage in the sand and grayed aquifers. billion gallons of available ground water is estimated to be in storage in the sand and gravel aquifers in the area. The area withdraws an average of 3.3 Mgal/d (million gallons per day) of water in June, July, and August and 2 Mgal/d during the remainder of the year. (USGS) W81-01028

USE OF GEOPHYSICAL LOGS TO ESTIMATE WATER-QUALITY TRENDS IN CARBONATE **AOUIFERS**

Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 7B. W81-01029

WATER-RESOURCES RECONNAISSANCE OF THE SOUTHEASTERN PART OF ST. PAUL ISLAND, PRIBILOF ISLANDS, ALASKA, Geological Survey, Anchorage, AK. Water Resources Div.

For primary bibliographic entry see Field 4A. W81-01033

GEOLOGIC ASPECTS OF THE SURFICIAL AQUIFER IN THE UPPER EAST COAST PLANNING AREA, SOUTHEAST FLORIDA, Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 4B. W81-01038

GEOLOGY AND GROUND WATER IN NORTH-CENTRAL SANTA CRUZ COUNTY. CALIFORNIA,

Geological Survey, Menlo Park, CA. Water Resources Div. For primary bibliographic entry see Field 7C. W81-01044

GROUND-WATER LEVELS IN NEW MEXICO.

1977, Geological Survey, Albuquerque, NM. Water Resources Div For primary bibliographic entry see Field 7C.

DIGITAL-SIMULATION AND PROJECTION OF HEAD CHANGES IN THE POTOMAC-RARITAN-MAGOTHY AQUIFER SYSTEM, COASTAL PLAIN, NEW JERSEY, Geological Survey, Trenton, NJ. Water Resources Div.

Div. J. E. Luzier.

J. E. LUZIET.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115768, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-11, May, 1980. 72 p, 32 Fig, 6 Tab, 33 Ref.

Descriptors: *Groundwater resources, *Model studies, *Hydrogeology, *Aquifer characteristics, *New Jersey, Computer models, Water supply, Pumping, Drawdown, Encroachment, Saline water, Water yield, Potentiometric level, Groundwater recharge, Hydrologic properties, Leakage, Transmissivity, Groundwater movement, Simula-tion analysis, Evaluation, Head loss, *Coastal Plain(NJ), *Potomac-Raritan-Magothy aquifer

A digital model was used to simulate the response of the Potomac-Raritan-Magothy aquifer system to pumping stresses during the 18-year period, 1956-73. The model was used to compute projected potentiometric heads and trends to the year 2000. Three sets of conditions were simulated: (1) no increase in groundwater extractions; (2) continued growth in groundwater extractions at the rate of 3% annually; and (3) continued growth in groundwater extractions at the rate of 3% annually, in conjunction with the activation of a freshwater head barrier in the fresh-salty water transition zone. Under the first set of conditions, further head reduction would cease over very large regions within two years. Under the second set of conditions, the broad cone of depression would broaden and deepen. Heads would range from 60 to 160 feet below mean sea level with declines after 1973 teet below mean sea level with declines after 1973 approaching 90 feet in some areas. The resultant steeper hydraulic gradients would accelerate the movement of salty ground water toward the pumping centers. If a freshwater head barrier were constructed across a 35-mile stretch in Gloucester, Camden, and Burliston Counties the total reter of Camden, and Burlinton Counties, the total rates of injection needed would range from about 56 cubic

feet per second in year 1984 to about 95 cubic feet per second in year 2000. Barrier recharge rates would be equivalent to about 20% of the ground water pumped. (USGS) W81-01185

DEVELOPMENT AND USE OF A MATHEMATICAL MODEL OF THE SAN BERNARDINO VALLEY GROUND-WATER BASIN, CALIFORNIA,

Geological Survey, Menlo Park, CA. Water Resources Div

sources Div.

W. F. Hardt, and C. B. Hutchinson.

Available from the OFSS, USGS Box 25425, Fed.

Ctr., Denver, CO 80225, Price: \$14.50 in paper copy, \$4.00 in microfiche. Geological Survey Open-File Report 80-576 (WRI), September, 1980.

80 p. 19 Fig, 1 Plate, 8 Tab, 37 Ref.

Descriptors: *Model studies, *Mathematical models, *Aquifer characteristics, *Groundwater basins, *California, Hydrologic data, Finite element analysis, Hydrogeology, Groundwater movement, Artesian wells, Pumping, Drawdown, Artificial recharge, Natural recharge, Water level fluctuations, Potentiometric level, Transmissivity, Storage coefficient, Maps, *San Bernardino Valley(CA), Projections.

Part of the San Bernardino urbanized area in California overlies formerly swampy lands with a history of flowing wells. This area, upgradient from and adjacent to the San Jacinto fault, contains a zone in an alluvial ground-water basin that is under artesian pressure. Since 1945, withdrawals have exceeded recharge and caused head declines of more than 100 feet. Artificial recharge of imported water in the upgradient areas may cause ground-water levels to rise, which could cause abandoned but unplugged wells to resume flowing. If so, structures could be damaged. A two-layer Galerkin finite-lement digital model was used for predicting the rate and extent of the rise in water levels from 1975 to 2000. Six hydrologic conditions were modeled for the basin. Artificial recharge of one-half entitlement and full entitlement from the California Aqueduct were each coupled with low, Part of the San Bernardino urbanized area in Cali-California Aqueduct were each coupled with low, average, and high natural recharge to the basin. According to model predictions, the greatest water According to moder predictions, the greatest water level rises will be along the San Bernardino front. This area encompasses the artificial recharge sites and also has a thick section of unsaturated sediments for storing ground water. The formerly swampy lands between Warm Creek and the Santa Ana River adjacent to the San Jacinto fault have Ana River adjacent to the Saan Jacinto naut have the said to the land surface as early as 1983 under maximum recharge conditions and 1970-74 average pumping conditions. If pumping rates are reduced in the Warm Creek area, water levels may rise to land surface prior to the dates predicted by the conductor of the crificial scholars. the model, regardless of the artificial-recharge program. (USGS)
W81-01186

SIMULATED EFFECTS OF A PROPOSED WELL FIELD ON THE GROUNDWATER SYSTEM IN THE SALT RIVER INDIAN RES-ERVATION, MARICOPA COUNTY, ARIZONA, Geological Survey, Tucson, AZ. Water Resources

P. P. Ross. Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: \$3.25 in paper copy, \$3.50 in microfiche. Geological Survey Open-File Report 80-503-W, April, 1980. 22 p, 7 Fig, 12 Ref.

Descriptors: *Model studies, *Simulation analysis, *Groundwater, *Aquifer characteristics, *Arizona, Hydrogeology, Irrigation wells, Water levels, Withdrawal, Pumping, Drawdown, Overdraft, Recharge, Digital computers, Computer models, *Maricopa County(AZ), Salt River Indian Reservation, Well field.

A finite-difference digital model was developed to simulate the effects of a proposed well field on the water levels in existing wells in the Salt River Indian Reservation, which is in the southeastern part of Paradise Valley in central Arizona. The

Lakes-Group 2H

model area includes about 600 square miles in Paradise Valley and the adjoining Salt River Valley. In 1975 about 37,500 acre-feet of ground water was withdrawn for irrigation in the Salt River Indian Reservation. The proposed well field would withdraw as much as 45,000 acre-feet per year of additional irrigation water north of the Arizona Canal. The model was calibrated by using measured water-level declines for 1923-76 and simulated declines for 1946-75. The calibrated model was then used to predict water-level declines, based on projected amounts of pumpage, after 20 years of pumping. The rate of water-level decline would be an additional 2 to 6 feet per year in existing wells after 20 years of pumping in the proposed well field. The model was more sensitive to changes in pumpage distribution and in pummodel area includes about 600 square miles in to changes in pumpage distribution and in pumpage and recharge amounts than to changes in transmissivity and specific yield. (USGS) W81-01191

APPROXIMATE ALTITUDE OF WATER LEVELS IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS IN THE HOUSTON AREA, TEXAS, SPRING 1979 AND SPRING

Geological Survey, Austin, TX. Water Resources

R. R. Gabrysch.
Available from the OFSS, USGS Box 25425, Fed.
Ctr., Denver, CO 80225, Price: \$4.75 in paper copy, \$2.00 in microfiche. Geological Survey Open-File Report 80-579, June, 1980. 4 Sheets, 1 Ref.

Descriptors: *Groundwater, *Water wells, *Water levels, *Potentiometric level, *Maps, Contours, Aquifers, Water level fluctuations, Texas, *Houston area(TX), Chicot aquifer, Evangeline aquifer.

These four maps show water levels in wells in the Houston, Texas, area in (1) the Chicot aquifer, spring 1979; (2) the Evangeline aquifer, spring 1979; (3) the Chicot aquifer, spring 1980; and (4) the Evangeline aquifer, spring 1980. Both the Chicot and Evangeline aquifers are composed of several sand layers with different potentiometric surfaces. These maps, however, show approximations of single potentiometric surfaces that represent composite hydraulic heads.

W81-01196

AVAILABILITY AND QUALITY OF GROUND-WATER, SOUTHERN UTE INDIAN RESERVA-TION, SOUTHWESTERN COLORADO, Geological Survey, Lakewood, CO. Water Re-

sources Div. For primary bibliographic entry see Field 5B. W81-01197

2G. Water In Soils

THIRD-ORDER INTEGRAL RELATION BETWEEN SORPTIVITY AND SOIL WATER DIFFUSIVITY USING BRUTSAERT'S TECH-NIQUE, Griffith Univ., Nathan (Australia). School of Aus-

tralian Environmental Studies.

J-Y. Parlange, R. D. Braddock, and I. Lisle

Soil Science Society of America Journal, Vol 44, No 5, p 889-891, September-October, 1980. 1 Tab,

Descriptors: *Diffusivity, *Soil water, *Sorption, Soil physics, Brutsaert's technique, Equations.

An improvement in the understanding of mathematical relationships between sorptivity and soil-water diffusivity is presented. This result can be used to predict soil-water diffusivity from sorptivity measurements in a wide range of soil condi-tions. Precision of this method is discussed for two general classes of soil-water diffusivities. (Cassar-FRC) W81-01076

COMPARATIVE RESISTANCE OF THE SOIL AND THE PLANT TO WATER TRANSPORT,

Illinois Univ. at Urbana-Champaign. Dept. of

Botany. W. E. Blizzard, and J. S. Boyer. Plant Physiology, Vol 66, No 5, p 809-814, November, 1980. 6 Fig, 2 Tab, 30 Ref.

Descriptors: *Plant physiology, *Water balance, Soil water, *Soil water movement, *Soil-water-plant relationships, *Flow resistance, Evapotran-spiration, Groundwater potential, Mass transfer, Mathematical studies.

Resistance to water transport was compared in soils and plants. Direct measurements were made of soil, root, and leaf water potentials and the flux of water through the soil-plant system to the evap-oration sites in the leaf. In measurements made in soybeans, with water being transported at a steady rate, water potential differences between root and leaf over the range of soil water potentials from - 0.2 to -11 bars. As the water in the soil was being used up, water flow through both the soil and the plant decreased to one-tenth the maximum rate. However, both the soil and the plant resistance remained at a higher level than soil resistance to water transport over the entire range of soil water availability studied. It is suggested that, at least in young plants, the plant resistance is the largest resistance factor in the soil-plant system over the resistance factor in the soil-plant system over the range of soil water likely to be encountered. Therefore, alterations in water transport characteristics of the plant could be a major factor on leaf water status and on the growth of plants in both moist and dry soils. (Baker-FRC)

A CLOSED-FORM EQUATION FOR PREDICTING THE HYDRAULIC CONDUCTIVITY OF LINSATURATED SOILS.

CNSAILURATED SUILS, Science and Education Administration, Riverside, CA. Salinity Lab. M. T. van Genuchten. Soil Science Society of America Journal, Vol 44, No 5, p 892-898, September/October, 1980. 9 Fig, 1 Tab, 21 Ref.

Descriptors: *Hydraulic conductivity, *Soil water movement, *Diffusivity, Unsaturated flow, Muslem method, Burdine method, Mathematical

Hydraulic conductivity results obtained with the closed-form analytical expressions based on the Mualem model were compared with observed hydraulic conductivity data for five soils with widely varying hydraulic properties. In 4 of 5 cases, the hydraulic conductivity was predicted well. A reasonable description of the soil-water retention curve at low water contents was found to be curve at low water contents was found to be important for accurately predicting the unsaturated hydraulic conductivity. (Cassar-FRC)

EFFECTS OF BICARBONATE ON SODIUM HAZARD OF IRRIGATION WATER: ALTERNATIVE FORMULATION,

Texas A and M Univ. Research Center, El Paso. S. Mivamoto.

S. Miyamoto. Soil Science Society of America Journal, Vol 44, No 5, p 1079-1084, September/October, 1980. 4 Tab, 21 Ref.

Descriptors: *Sodium, *Irrigation water, *Bicarbonates, *Drainage water, Effects, Sodium bicarbonate, Calcium, Magnesium, Equations, Satura-

An alternative formulation for predicting effects of An alternative formulation for predicting effects of bicarbonates on sodicity of irrigation waters, drainage water, and soils is presented. A comparison of results using this method with published data shows that the conventional equation using saturation index overestimates sodicity of water having a high ratio of calcium to bicarbonate and underesti-mates otherwise. If the pH of a drainage water is known, a second power polynomial approximation can be used to predict sodicity. Although the proposed methods are more complex than the conven-tional method, programmable calculators or mini-computers can be used satisfactorily. (Cassar-FRC) W81-01089

SATURATED-UNSATURATED FLOW IN RADIAL DIRECTIONS GENERATED BY AN INJECTION WELL, Princeton Univ., NJ. Dept. of Civil Engineering.

D. K. Babu. Soil Science Society of America Journal, Vol 44, No 5, p 915-921, September/October, 1980. 6 Fig.

Descriptors: *Injection wells, *Soil water move-ment, Saturated flow, Leaching, Infiltration, Equa-

The techniques and formulas derived in this paper can produce reliable estimates of flow quantities in can produce reliable estimates of flow quantities in solute transport and salt leaching phenomena. The saturated-unsaturated flow conditions are produced by a vertically-placed line source that injects water into the soil at a constant rate. Flow takes place only in horizontal radial directions. Singular perturbation methods are applied to derive a solution, uniformly valid at all points of time and space, as a power series in the perturbation parameter. Location of the wetting front and the transition face between saturated and unsaturated flow regimes may be determined by formstated flow regimes may be determined by rated flow regimes may be determined by formulas. (Cassar-FRC) W81-01091

COMPARISON OF ONE-STEP OUTFLOW LABORATORY METHOD TO AN IN SITU METHOD FOR MEASURING HYDRAULIC

CONDUCTIVITY,
Wisconsin Univ., Madison. Dept. of Soil Science.
D. B. Jaynes, and E. J. Tyler.
Soil Science Society of America Journal, Vol 44, No 5, p 903-907, September/October, 1980. 4 Fig, 1 Tab, 33 Ref.

Descriptors: *Hydraulic conductivity, *Passioura method, *Soil water movement, Diffusivity, Unsaturated flow, Laboratory tests, Percolation.

The Passioura modification of the one-step outflow method for determining unsaturated hydraulic con-ductivity is compared with data obtained from the in situ crust method. Results, using three soils, agreed well. Discrepancies between hydraulic conductivity values obtained were attributed to hysteresis effects. With modifications, this inexpensive, rapid laboratory method can be used to measure hydraulic conductivity in constantly wet soils such as on-site liquid waste disposal systems. (Cassar-FRC) W81-01092

2H. Lakes

LAKES OF OREGON: VOLUME 6. DOUGLAS

COUNTY, Geological Survey, Portland, OR. Water Resources Div J. F. Rinella.

Geological Survey Open-File Report, 1979. 123 p, 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Lakes, *Oregon, *Investigations, *Hydrologic data, *Water quality, Drainage area, Elevation, Volume, Lake morphology, Lake morphometry, Thermal: stratification, Inflow, Discharge(Water), Chemical analysis, Water utilization, Areal photography, Bathymetry, Mapping, *Douglas County lakes(OR).

An inventory of lakes and reservoirs in Oregon is useful in evaluating the surface-water supply of the State and in providing answers to questions about Oregon's lakes. Much of the information on lakes and reservoirs previously collected by Federal and State agencies has never been published. Those State agencies has never been published. Those data were compiled and used as a basis for collecting additional information. This report provides information for use by city, county, and State planning groups in planning interpretative studies. The information also will be useful to sportsmen, tourists, and others interested in preserving the recreational value of Oregon's lakes. In addition to office compilation of existing data, each lake was visited. Most visits were made in summer or early fall when lakes were most accessible and when

Field 2—WATER CYCLE

Group 2H-Lakes

water temperature and biological activity were near maximum. There are no commonly accepted criteria for distinguishing among lakes, ponds, pools, sloughs, and other water bodies. In general, any lake or impoundment with a surface area greater than 5 acres is included in this inventory, but a few smaller lakes are also included. Natural ephemeral lakes are not included nor are privately wned lakes or impoundments. (USGS)

A SALT BALANCE SIMULATION MODEL OF LAKE NASSER.

Academy of Scientific Research and Technology, Cairo (Egypt).

G. Guariso, D. Whittington, M. E. Abdel-Samie, and C. Kramer.

Water Supply and Management, Vol 4, No 112, p 73-80, 1980. 1 Fig, 3 Tab, 23 Ref.

Descriptors: *Lake Nasser, *Salinity, *Salt balance, *Irrigation water, *Artificial lakes, *Model studies, Reservoir, Lakes, Aswan High Dam, Nile River, Impounded waters, Discharge(Water),

Careful examinations of salt concentrations in Lake Nasser are necessary because salinization and water-logging presently exist throughout much of Egyptian agricultural land. A mass balance equation and a salt balance simulation model were used to calculate total dissolved solids in water dis-charged from the Aswan high dam for the years 1880-1976. Salinity trends and evaluation of the dam's impact cannot be predicted using data from dam's impact cannot be predicted using data from a 10 to 15 year period. Rather, salinity is dependent on the pattern of water flowing into the Lake. Salinity is higher during years of high flood because evaporation losses are greater when the reservoir is full. Volumes of the lake water in any given month were calculated using inflow, seepage losses, evaporation losses and discharge from the dam. The salt balance simulation model was used to preserve a table listing water influence during. cani. The sain obtained similation moder was used to prepare a table listing water inflow and outflow, salt inflow and outflow, seepage and evaporation losses, total water volume as of July 31, and salt concentration for the years 1890-1919. (Cassar-FRC) W81-01073

HYPOLIMNETIC METABOLISM IN THREE

CAPE COD LAKES, Connecticut Univ., Storrs. Biological Sciences

P. H. Rich American Midland Naturalist, Vol 104, No 1, p 102-109, July, 1980. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Photosynthesis, *Hypolimnion, *Light penetration, *Oxidation, Stratification, Lakes, Oxygen, Respiration, Carbon, Eutrophication, Oligotrophy, Mesotrophy, Limnology, Oxidation-reduction potential, Water properties,

The oxidation potential of hypolimnetic organic matter and the carbon dioxide levels were determined in three closed-basin kettle lakes of similar morphometry on Cape Cod. Areal hypolimnetic measurements of O2 and dissolved inorganic measurements of O2 and dissolved inorganic carbon (DIC) were taken under stratified condi-tions in the summer of 1976. Lakes Gull and Hathaway showed O2 deficits characteristic of oli-gotrophic ponds, while Mares Pond was distinctly mesotrophic DIC increments gave borderline eu-trophic results for Mares Pond. Both O2 uptake and DIC release were observed to be inversely and DIC release were observed to be inversely correlated to the amount of light penetrating to the hypolimnion. Ratios of DIC released to O2 taken up (by respiration) in the hypolimnia of the three lakes ranged from 1.4 to 3.4. This ratio was also directly correlated with the amount of light reaching the hypolimnion, suggesting that O2 uptake is suppressed more by underwater light than it is by DIC release. It was also hypothesized that lakes may increase their stock of alternate electron acceptors by contributing electrons to asserbic above. ceptors by contributing electrons to anaerobic photosynthesis at or below the depth of light compensation. (Geiger-FRC) W81-01128

2I. Water In Plants

COMPARATIVE RESISTANCE OF THE SOIL AND THE PLANT TO WATER TRANSPORT, Illinois Univ. at Urbana-Champaign. Dept. of For primary bibliographic entry see Field 2G. W81-01082

2J. Erosion and Sedimentation

SEDIMENT TRANSPORT OF STREAMS TRI-BUTARY TO SAN FRANCISCO, SAN PABLO, AND SUISUN BAYS, CALIFORNIA, 1909-66, Geological Survey, Menlo Park, CA. Water Resources Div. G. Porterfield.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-118622. Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-64, August, 1980. 92 p, 19 Fig, 31 Tab, 33 Ref.

Descriptors: *Sediment transport, *Streamflow, *Bays, *California, Land use, Runoff, Sediment Bays, *California, Land use, Runoff, Sediment discharge, Sedimentation rates, Sediment load, Particle size, History, Water quality, Water re-sources development, Hydrologic data, San Fran-cisco Bay(CA), San Pablo Bay(CA), Suisun Bay(CA).

A review of historical sedimentation data is presented, results of sediment-data collection for water years 1957-59 are summarized, and long-term sediment-discharge estimates from a preliminary report are updated. Comparison of results based on 3 years of data to those for the 10 water years, 1957-66, provides an indication of the adequacy of the data obtained during the short period of define the long-term relation between sediment quacy of the data obtained utiling the short period to define the long-term relation between sediment transport and streamflow. During 1909-66, sediment was transported to the entire San Francisco Bay system at an average rate of 8.6 million cubic yards per year. The Sacramento and San Joaquin River basins provided about 83% of the sediment inflow to the system annually during 1957-66 and 86% during 1909-66. About 98% of this inflow above during 1907-66. About 98% of this inflow was measured or estimated at sediment measuring sites. Measured sediment inflow directly to the bays comprised only about 40% of the total discharged by basins directly tributary to the bays. About 90% of the total sediment discharge to the delta and the bays in the San Francisco Bay system. thus was determined on the basis of systematic measurements. (USGS) W81-01034

SEDIMENT TRANSPORT IN THE SNAKE AND CLEARWATER RIVERS IN THE VICINI-TY OF LEWISTON, IDAHO, Geological Survey, Boise, ID. Water Resources

Div. M. L. Jones, and H. R. Seitz. Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: \$24.00 in paper copy, \$3.50 in microfiche. Geological Survey Open-File Report 80-990 (WRI), August, 1980. 179 p. 23 Fig. 18 Tab, 18 Ref.

Descriptors: *Sediment transport, *Baseline studies, "Pre-impoundment, "Post-impoundment, "Idaho, Hydrologic data, Suspended load, Bed load, Streamflow, Channel morphology, Data collections, Sedimentation, "Snake River(ID), Clearwater River(ID).

During the period 1972-79, bedload in the Clear-water River in the vicinity of Lewiston, Idaho, ranged from about 50,000 tons per year in 1972 and ranged from about 50,000 tons per year in 1972 and 1974 to about 1,000 tons per year in the drought years of 1973 and 1977. Suspended-sediment load at the same location ranged from about 1,000,000 tons per year to about 50,000 tons per year for the same respective years. In the Snake River, bedload ranged from short 200,000 tons per year for the same respective years. ranged from about 200,000 tons per year for 1972 and 1974 to about 10,000 tons per year in 1973; bedload was too minimal for determination in 1977. Suspended-sediment load ranged from about 5,000,000 tons per year in 1974 to about 50,000 tons

in 1977. Bedload thus ranged from about 2 to 10% of suspended load and averaged about 5%. For either river, bedload particle size was bimodal. Modes were in the medium- to course-sand range and in the very coarse-gravel range. Suspended-sediment particle size was generally finer than sand. Thus, particles constituting bedload were distinctively larger in size than particles constitut-ing suspended load. (USGS) W81-01037

KINETICS OF TRACE METAL PARTITION-ING IN MODEL ANOXIC MARINE SEDI-MENTS

Oregon State Univ., Corvallis. Dept. of Civil Engi-For primary bibliographic entry see Field 5B. W81-01154

2K. Chemical Processes

GEOCHEMISTRY OF WATER IN THE FORT UNION FORMATION OF THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources

nary bibliographic entry see Field 5B. W81-01041

THE MONOSACCHARIDE SPECTRA OF NAT-

URAL WATERS,
Delaware Univ., Lewes. Marine Studies Complex.
K. Mopper, R. Dawson, G. Liebezeit, and V.

Marine Chemistry, Vol 10, No 1, p 55-66, October, 1980. 4 Fig, 2 Tab, 32 Ref.

Descriptors: *Carbohydrates, *Sampling, *Natural streams, Chromatography, Separation techniques, Sea water, Groundwater, Estuaries, Laboratory tests, Desalination, Chemical reactions, Carbon cycle, Photosynthesis, Aquatic environments.

A variety of water and sediment pore water samples from a wide range of environments were collected and analyzed for monosaccharides by liquid chromatography. Twelve sugars were posi-tively identified from desalted extracts of the water samples. The dominant monosaccharides in all samples. The dominant monosaccharides in all samples were glucose and fructose. Over 150 seawater and sediment pore water samples had levels of fructose which were highly correlated with their levels of glucose. The epimerization reaction of glucose to fructose was examined in laboratory kinetic tests using sterilized samples of natural seawater kept in the dark. The forward rate constant was determined at 2 and 25 degrees, as was the time required for each system to other was the time required for each system to attain equilibrium. The actual ratio of fructose to glucose in natural water samples was found to be independent of the total monosaccharide levels, and was usually in the range of 1.0-1.4/1. Factors which may have been responsible for the discrepancy in the predicted and observed ratios such as biologi-cal sources of fructose, preferential utilization of glucose or fructose, and preferential formation of fructose-transition metal ion associations were con-sidered. (Geiger-FRC)

IN-SITU REGISTRATION OF OXYGEN UTILIZATION AT SEDIMENT-WATER INTER-

Kiel Univ. (Germany, F.R.). Inst. fuer Meeres-

H. P. Hansen, K. Grasshoff, and J. Petersen Marine Chemistry, Vol 10, No 1, p 47-54, October, 1980. 6 Fig. 7 Ref.

Descriptors: *Sediment-water interfaces, *Oxygen demand, *Measurement, Equipment, Sands, Mud, Water temperature, Water pressure, Kiel Bight.

Oxygen utilization of the sediments in the Kiel Bight was measured using a polyacrylic dome an-chored over natural sediments. Vertical convec-tion was produced by means of a small pump, and

Water Yield Improvement—Group 3B

oxygen partial pressure and temperature were measured at 20 minute intervals by an automatic data system. After recovery, the data stored in digitized form on magnetic tape was read by a microprocessor, interpreted, listed, and plotted against time. Sandy sediments showed a decrease in oxygen saturation which was nearly independent of temperature. Muddy sediments at low temperatures showed a similarly slow decrease, but a peratures showed a similarly slow decrease, but a considerably increased oxygen utilization with increasing temperatures. Sediment type and temperature were the dominating control parameters for relative oxygen utilization, and the absolute oxygen consumption of a given sediment type at a given temperature was linear function of oxygen concentration. (Small-FRC) W81-01054

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF NOVEL POROUS SUB-STRATES FOR ULTRAFILTRATION, DESALI-NATION, AND WATER RECLAMATION, Gulf South Research Inst., New Orleans,

Dept. of Polymer. I. Cabasso.

I. Caossso. Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147787, Price codes: A05 in paper copy, A01 in microfiche. Final Report submitted to Office of Water Research and Technology, January 31, 1980. 95 p, 60 Fig. 11 Tab. OWRT-C-B0294-S(No 8521)(1), 14-Fig, 11 1ab. C 34-0001-8521(1).

Descriptors: *Membranes, *Reverse osmosis, *Polymers, *Water reuse, *Testing procedures, Porous substrates, Filtration, Reclaimed water, Desalination, Poly(dimethyl phenylene oxide), UItrafiltration. Composite membrane

Poly(phenylene oxide) (PPO) polymers were successfully cast into an anisotropic porous substrate, which may be utilized in water reclamation (by which may be utilized in water rectanation (utilization and composite membranes). High hydraulic permeabilities and good mechanical stability are characteristic of these macrovoid-free membranes. The membranes are east in a continuous fashion to exhibit hydrophobic (or hydrophilic) properties. P-amino-naphthalene sulfonic acid was applied from aqueous solution to chemically was applied from aqueous solution to chemically interact and produce an ionic, charged surface. Thus, low molecular weight (approximately 250 MW) organo-ionic solutes can be efficiently removed in a low pressure ultrafiliration process. Membrane productivity in this operational mode is very high (50-200 gfd in pressure ranges of 20-100 psi). As such, low molecular weight surfactant separation is possible, and consequently, the purification of water by removal of low molecular weight, neutral, organic contaminants, which are trapped in the transient miscelle formation at the membrane-solute interface, is very efficient. The membrane-solute interface, is very efficient. The substrate displays a crystalline 'coral' morphology which has the endurance required from the support component of a reverse osmosis membrane. This, combined with the superb chemical stability of the membrane, allows deposition of a permaselective, ultrathin membrane from solvent systems which would dissolve a conventional polysulfone support (e.g., acetone, DMF, DMA). As such, cellulose acetate and cellulose triacetate were decentities acetate and centities tracetate were de-posited on an MPPO support from acetone/diox-ane solution. Also, quaternary polymers were de-posited onto a sulfonated (sulfonic acid) surface to form a permaselective skin consisting of polyelec-trolyte layers. W81-01001

DESALINATION/POWER CYCLES WITH THE BIPHASE ROTARY SEPARATOR AND TUR-BINE.

Biphase Energy Systems, Santa Monica, CA.

P. L. Limburg.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB81-150237,

Price codes: A05 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, September, 1980. 83 p, 46 Fig. 13 Tab. 11 Ref. OWRT-G90028-D(No 9407)(1), 14-34-0001-9407.

Descriptors: *Desalination, *Desalination process, *Equipment, *Turbines, *Separation techniques, *Separation, Design, *Reverse osmosis, Multiple-effect distillation, Vapor compression, Energy recovery, Costs, Binase turbine, Rotary Separator, Power production, Cycle studies, Thermal power plants, Waste heat

The Biphase Rotary Separator Turbine (RST) generates fresh water and power when using salt water as a working fluid. Cycle studies of single-and two-stage RST cycles determined water-production rates to be 0.6 to 1.8 pounds per thousand btus of heat input and net power-production efficiencies of 2 to 10%, depending on cycle configuration and the maximum saltwater temperature. The Biphase RST can be beneficially integrated with conventional desalination processes. Cycles studied include a topping cycle for distillation plants, shaft-power-source cycle for reverse osmosis and vapor-compression plants, and a reverse-sis and vapor-compression plants, and a reversephants, shart-power-source yole for reverse sumo-sis and vapor-compression plants, and a reverse-osmosis cycle recovering the reject-brine pressure energy. Short duration tests of a Biphase RST showed that fresh water production (30 ppm TDS) from seawater is feasible. Conceptual design stud-ies were made of a single-stage desalination/power system suitable for a first demonstration plant. The system produces 9000 gallons per day and 90 horsepower from the exhaust-gas energy of a 2125 horsepower diesel engine. W81-01165

RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESALINATION, UOP, Inc., San Diego, CA. Fluid Systems Div. R. L. Riley, G. R. Hightower, C. R. Lyons, C. E. Milstead, and M. W. Seroy. Available from the National Technical Information Service, Springfield, VA 22161 as PB81-151953, Price codes: A08 in page conv. A01 in price fiche.

Service, Springheld, VA 22101 as PB81-151953. Price codes: A08 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Re-search and Technology, March, 1975. 130 p, 59 Fig, 29 Tab, 12 Ref. OWRT (No 3191)(1), 14-30-3191.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membranes, Membrane processes, Sea water, Thin-film composite membranes, Spiral elements, Membrane types.

Research and development work under this contract covered the period January 1, 1973 through December 31, 1974. Four distinct types of thin-film composite reverse osmosis membranes were developed and scaled up for incorporation into spiral wound elements. The first membrane had cellulose wound elements. The first memorane has cellulose triacetate formed directly on a porous cellulose nitrate-cellulose acetate support. The second memorane, a polyurea thin film composite (designated as NS-100) was formed by an in-situ interfacial polymerization on a fabric reinforced polysulfone support. Both of these membranes demonstrated salt rejections greater than 99.5% from a 35,000 ppm sodium chloride feed; product water fluxes were in the range of 12 to 17 gal/ft sup 2-day. The were in the range of 12 to 17 gal/ft sup 2-day. The third membrane was a polyamide type referred to as PA-100. The fourth and last membrane investigated consisted of a poly (ether/amide) formulation and was designated PA-300. Laboratory tests with the PA-100 and PA-300 membranes showed water fluxes in excess of 23 gal/ft sup 2-day and salt rejection efficiencies greater than 99.3% desalting simulated seawater at 1000 psi. A major part of the program was the development of spiral wound alternate from each of these membranes. wound elements from each of these membrane types. Elements were prepared using various methods of construction and adhesives to improve element reliability and minimize flux decline. Field evaluation testing with cellulose triacetate composite membrane elements were conducted at the Sea World Marine Park in San Diego, California. Test-ing was prematurely terminated after 3200 hours because of problems with excessive membrane fouling.

W81-01166

RESEARCH AND DEVELOPMENT ON A SPIRAL-WOUND MEMBRANE SYSTEM FOR SINGLE-STAGE SEAWATER DESLINATION, UOP, Inc., San Diego, CA. Fluid Systems Div. R. L. Riley, C. R. Lyons, C. E. Milstead, M. W. Seroy, and M. Tagami. Available from the National Technical Information Service, Springfield, VA 22161 as PB81-151938, Price codes: A08 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, March 1, 1976. 144 p, 21 Fig. 49 Tab, 7 Ref. OWRT (No 3303)(1), 14-30-3303(1).

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membranes, Membrane processes, Seawater, Brackish water, Thin-film composite membranes, Spiral elements, Membrane production, Pilot plant.

Work under this contract covered the period January 1, 1975 through December 31, 1975. Emphasis was placed on developing a thin-film composite spiral reverse osmosis membrane system to desalt seawater in a single stage at a maximum pressure of 1,000 psi. Two thin film composite membrane vere developed concurrently to achieve this objective. The first membrane was a cellulose triacetate thin-film on a porous cellulose nitrate -cellulose acetate support. The second membrane was a poly (ether/amide) designated PA-300 cast on a porous polysulfone. A major objective of this program was the design, construction and operation of a fabrication assembly for production of 14-inch wide PA-300 membrane. This machine ation of a laorication assembly for production of 14-inch wide PA-300 membrane. This machine produced membranes continuously in lengths up to 550 ft. that yielded water fluxes over 20 gals/ft sup 2-day and salt rejections greater than 99.5% while desalting a 35,000 ppm sodium chloride feed at 1000 psi. Extensive field evaluation tests with both 2-inch and 4-inch diameter spiral module elements were conducted on seawater at Sea World, San Diego, California and the OWRT Sea Water Test Diego, California and the OWRT Sea Water Test Facility at Wrightsville Beach, North Carolina. In addition, brackish water desalination studies were undertaken with the PA-300 membrane at the OWRT Brackish Water Test Facility, Roswell, New Mexico. Other areas of research included characterization of PA-300 membrane system properties with regard to wet-dry cycling, chlorine stability and rejection of organic compounds. Additional studies included further optimization of the fabric reinforced poly-sulfane support. W81-01167

3B. Water Yield Improvement

THE USE OF THE COMPARTMENTED RES-ERVOIR IN WATER HARVESTING AGRISYS-TEMS.

Arizona Water Resources Research Center, Tucson.

In: Arid Land Plant Resources, Proceedings of the International Arid Lands Conference on Plant Re-sources, October 8-15, 1978, International Center for Arid and Semiarid Land Studies, Texas Tech. Univ. Lubbock, p 482-500, July, 1979. 5 Fig, 37 Ref. OWRT-B-015-ARIZ(3), 14-01-0001-1425.

Descriptors: *Water harvesting, *Rain water, *Rainfall-runoff relationships, Runoff, *Water conservation, Reservoir evaporation control, *Reservoir storage, Arid lands, Water yield improvement, Water loss, Reservoir design, Surface waters, Water storage, Storage capacity, Computer

Water harvesting agrisystems or the coupling of artificially collected rain water with agriculture and a surface storage system, offer a promising way of increasing both the quantity and dependability of water in arid and semiarid lands. The use of a compartmented reservoir in conjunction with these agrisystems provides a relatively low-cost efficient method of storage as compared with conventional storage methods. Based on the principle that the division of a conventional reservoir into

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3B-Water Yield Improvement

compartments with the systematic pumping or transfer of water between compartments can achieve evaporation control through reduction of surface area, these reservoirs are demonstrated here to easily obtain efficiencies in excess of 50-60% where conventional reservoirs of the same 60% where conventional reservoirs of the same depth covering the same area were unable to sustain their own evaporation loss. A computer model has been developed (Crop-76) to study the parameters involved in this compartmented system and their relationship to each other using historical data. This model is briefly described and illustrated through its use in the design of a 16 ha Jojoba water harvesting agrisystem on retired farmland in the Avra Valley 32 km west of Tucson, Arizona. (Tickes-Arizona)
W81-01022

3C. Use Of Water Of Impaired Quality

APPLICATION OF SEWAGE EFFLUENT TO COLUMNS OF A MOUNTAIN MEADOW SOIL: I. ERRORS IN CALCULATING THE TRANSPORT OF IONIC SALTS, Colorado State Univ., Fort Collins. Dept. of

Agronomy. K. A. Barbarick, A. Klute, and B. R. Sabey. Soil Science Society of America Journal, Vol 44, No 5, p 921-924, September/October, 1980. 1 Fig, 3 Tab, 12 Ref.

Descriptors: *Sewage effluents, *Irrigation, *Soil-plant-water relationships, *Municipal wastes, Ion transport, Hayden(CO), Sewage disposal, Salts, Liquid wastes, Environmental effects

The effects of applying municipal sewage effluent from Hayden, Colorado, on a mountain meadow from Hayden, Colorado, on a mountain meadow soil were studied by irrigating soil-packed columns with the effluent for 12 weeks. Some columns were destructively sampled at intervals to determine bulk density and gravimetric moisture content. Five other columns contained porous cups at 7 depths for sampling the extracts. After the steady-state flow had been reached, transport of ionic salts was calculated. An error analysis showed that electrical conductivity measurements in the soil was calculated. An error analysis showed that electrical conductivity measurements in the soil extracts collected in the porous cups would have to be determined to the nearest 0.003 mmho per mt or reduce the calculated flux error to 10% at a 70 cm depth. Error in the fluxes increased with depth. (Cassar-FRC) W81-01090

IRRIGATION OF INTENSIVELY CULTURED PLANTATIONS WITH PAPER MILL EFFLU-ENT.

North Central Forest Experiment Station, Rhine-

lander, WI. E. A. Hansen, D. H. Dawson, and D. N. Tolsted. Tappi, Vol 63, No 11, p 139-143, November, 1980. 5 Fig. 2 Tab, 13 Ref.

Descriptors: *Soil-plant water relationships, *Pulp wastes, *Irrigation, *Forest management, Applica-tion methods, Industrial wastes, Waste water dis-posal, Effluents, Disposal, Planting management, Pulp and paper industry, Water pollution.

Use of paper mill effluent to irrigate short-rotation, Use of paper mill effluent to irrigate short-rotation, intensively cultivated plantations of Populus and Salix produced good growth of trees during the 3 years since planting in 1977. Total effluent applied at an average rate of 11 inches per week during the June to September growing season was 11.7 feet in 1977, 10.0 feet in 1978, and 36 feet in 1979. Populus 1977, 10.0 feet in 1978, and 36 feet in 1979. Populus growth averaged 3 feet per year during the first 2 years and 6 to 7 feet the third year. The Mead Corporation mills output of 32 mgd applied at the rate of 11 inches per week to 750 acres produced 2,600 tons of fiber per year. Concentrations of Na, Cl, and So4 in groundwater increased greatly, from pretreatment levels of 1, 1, and 4 ppm to 300, 400, and 190 ppm respectively after treatment. K, Ca, Mg, and N increased to a lesser extent. P, Mn, and Al did not change significantly. In order to reduce groundwater pollution, disposal sites should be near rivers or other natural drains. The second-arry-treated effluent reaching the groundwater ary-treated effluent reaching the groundwater

table was of better quality than the tertiary treated effluent normally discharged by the mill into a nearby river. (Cassar-FRC) W81-01094

EFFECT OF THE SALINITY OF IRRIGATION WATER ON WHEAT YIELD AND SOIL PROPERTIES.

Raja Balwant Singh Coll., Agra (India). Dept. of

Agricultural Chemistry.
B. Singh, and P. Narain.
Indian Journal of Agricultural Science, Vol 50, No
5, p 422-427, May, 1980. 3 Fig, 4 Tab, 7 Ref.

Descriptors: *Irrigation water, *Salinity, *Wheat, *Crop response, *Sodium chloride, Adsorption, India, Leaching, Cations, Hydraulic conductivity.

Experiments conducted in the same field during 1972-73 and 1973-74 indicated that wheat could tolerate irrigation with water having a salinity up to 8 mmhos per cm conductivity. When waters to 8 mmhos per cm conductivity. When waters with 1.5 and 2 times this conductivity were used, grain yield decreased by 29 and 69% respectively the first season, and 74 and 89% respectively the second season. Wheat was irrigated 4 times in 1972-73 and 5 times in 1973-74. Pearl millet was 1972-73 and 5 times in 1973-74. Pearl millet was grown as rotation crop and required 1 irrigation in 1973 and 3 in 1974. Salinity accumulated at a depth of 0 to 60 cm when water having a conductivity of more than 4 mmhos per cm was used, despite leaching by monsoon waters. The sodium adsorption ratio of the irrigation water and of the soil up to a depth of 30 cm increased. Hydraulic conductivity of soil decreased as salinity of irrigation water increased. (Cassar-FRC)

USING SALINE WATER FOR CROP PRODUC-TION IN NEW MEXICO, New Mexico State Univ., Las Cruces. Dept. of

New Mexico State Univ., Las Cruces. Dept. of Agronomy.
G. A. O'Connor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-148058, Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University Technical Completion Report No 127, December, 1980. 26 p., 2 Fig. 5 Tab, 9 Ref, Append. OWRT-A-061-NMEX(1), 14-34-0001-0133.

Descriptors: Salinity, Water management, Ground-water, *Supplemental irrigation, *Salt tolerance, Sorghum, *Crop response, *Impaired water use, Saline water, Irrigation water, *New Mexico, Greenhouse studies.

New Mexico has vast supplies of saline ground-waters whose use could expand irrigated agricul-ture and conserve good quality water for domestic use. Unfortunately, little is known of the long-term effects of such waters on soils and crops common to New Mexico. Thus, two studies were conducted to determine the feasibility of using various salinity waters (total dissolved solids 1,250-15,000 mg/l) Greenhouse data suggest that the most realistic way to utilize saline waters is as supplements to way to utilize saline waters is as supplements to normal fresh water irrigations. The degree of supplementation possible without severe yield reductions varies inversely with water salinity. However, very saline waters (10,000 and 15,000 mg/l TDS) are not likely to be of practical use for common agricultural crops at any degree of supplementation. Using saline water as the sole source of irrigation water is reasonable for long-term cultivation of common crops only with the lowest tivation of common crops only with the lowest salinity water (1,250 mg/l TDS). One season emergencies may be met with waters as saline as 2,500-5,000 mg/l TDS, but continued use will severely reduce yields. W81-01156

3D. Conservation In Domestic and Municipal Use

ANTICIPATE PIPE FREEZE-UPS, B. Block.

Water and Wastes Engineering, Vol 17, No 10, p

34-35 October, 1980, 2 Fig.

Descriptors: *Distribution systems, *Freezing, *Temperature control, Equipment, Kansas, Pipes, Potable water, Frost, Measurement, Instrumentation, Ice.

Since winters are very cold in Idaho, the city of Ketchum installed freeze-prevention devices in its Retchum installed freeze-prevention devices in its new 85,000 ft pipe sewage system to detect frost penetration and reduce the possibility of damage to the system and the wasting of water. The device consists of a temperature probe inserted into a one inch polyvinyl chloride conduit near the pipeline. The pipe has connecting thermistor leads which are adjoined along with the probe to a junction box situated on a utility pole. Each temperature probe is checked on a regular basis by a hand-held temperature meter. Eight temperature probes were installed at dead spots in the water system, and selected hydrants were used throughout the system for water wasting. Construction of the new sewer system took only one summer. Ketchum residents were concerned about freezing in the pipes because many of the residential areas had private wells and were not required to hook up to the municipal supply. Also, a number of the hook-ups were to resort structures that could not guarantee a steady flow demand. After the new system weathered one winter, a dead end section without the frost detecnon device did freeze up, but the following spring no sign of pipe damage was reported, and the pipe iayout in this section was altered to correct the problem. (Geiger-FRC) W81-01075 tion device did freeze up, but the following spring

3F. Conservation In Agriculture

THE USE OF THE COMPARTMENTED RES-ERVOIR IN WATER HARVESTING AGRISYSTEMS.

Arizona Water Resources Research Center, Tucson

For primary bibliographic entry see Field 3B. W81-01022

WHAT TO DO WHEN THE WELL RUNS DRY, J. Walsh

Science, Vol 210, No 4471, p 754-756, November,

*Aquifers, Descriptors: *Aquifers, *Irrigation systems, *Kansas, Corn, Grain sorghum, Irrigation permits, Groundwater, Agriculture, Cattle, Costs, Water management, Water shortage, Pumping, Great Plains, Water table

Reductions in supplies of irrigation water in West-ern Kansas in the summer of 1980 caused drastic decreases in corn crop yields. Grain crops were successfully grown in this region in previous years with heavy irrigation from the Ogallala aquifer. Estimates have shown that the underground water of this area may be depleted in 3 to 20 years, which will cause problems not only in the field of agriculture, but to the beef cattle industry as well. Since corn is most sensitive to drought during the pollination stage, research may aid in shortening the irrigation period to only the most effective segments of crop growth. Alternate crops requiring less irrigation such as grain sorghum are also being cultivated in place of corn. Careful management plans must be executed and cooperation between farmers and government researchers instated to stall the impending depletion of irrigation water supplies. Plans have been considered to set up pumping systems to obtain water from the Missouri River and the Dakota aquifer (an aquifer of the area much further underground) to supplement the water pumped from the Ogallala. The government will also allow owners of aquifer rights to claim depletion allowances to boost farm economies, crease land values, and aid the transition from irrigation farming. (Geiger-FRC) W81-01060

Effects On Water Of Man's Non-Water Activities—Group 4C

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SEEPAGE STUDY OF THE WEST SIDE AND SEEFAGE STUDY OF THE WEST SIDE AND WEST CANALS, BOX ELDER COUNTY, UTAH, Geological Survey, Salt Lake City, UT. Water Resources Div. R. W. Cruff.

Utah Department of Natural Resources Technical Publication No 67, 1980. 38 p. 3 Fig. 2 Tab. 1 Ref.

Descriptors: *Canal seepage, *Utah, *Hydrologic data, *Water resources, *Flow nets, Measurement, Water levels, Discharge(Water), Water temperature, Specific conductance, Evaluation, *Box Elder County(UT), *West Side Canal(UT), West Canal(UT).

A study of the gains or losses of the West Side and West Canals from Cutter Reservoir to near Penrose, Box Elder County, Utah, was made to aid in water allocation for the canal system. Four sets of seepage measurements made in 1978 were used in the analysis. Adjustments for fluctuations in flow in the canals were made from information obtained from water-stage recorders operated at selected locations along the canals during the time of each seepage run. The study showed no detectable gain or loss for the West Side Canal and a net loss of 50 or ioss for the West Side Canal and a net loss of 50 cubic feet per second for the West Canal. During the seepage runs, an average of 365 cubic feet per second entered the West Canal, thus the net loss was 13.7% of the available water. About 40% of this loss occurred within about 5% of the length studied on the West Canal. W81-01026

WATER-RESOURCES RECONNAISSANCE OF THE SOUTHEASTERN PART OF ST. PAUL ISLAND, PRIBILOF ISLANDS, ALASKA, Geological Survey, Anchorage, AK. Water Re-

sources Div. A. J. Feulner.

A. J. Feuner.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-226962,
Price codes: A02 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations
80-61, 1980. 12 p, 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Water resources, *Surveys, *Alaska, *Surface waters, *Groundwater resources, Water quality, Water supply, Available water, Aquifer characteristics, Islands, Lakes, Potable water, Salinity, Fish handling facilities, Baseline studies, *St Paul Island(AK).

A hydrologic reconnaissance of the southeastern part of St. Paul Island, Pribilof Islands, Alaska, was made in August 1979 to determine if sufficient was made in August 1971 to determine it sufficient freshwater is available for a proposed harbor and fish-processing facility. Only three wells were being used in 1979, two by the community of St. Paul and one by the Coast Guard Loran facility. All wells are in the southeastern part of the island. The island has no established surface drainage, and no springs were found on the eastern part of the island during the survey. Drainage of groundwater from the island is assumed to be by seepage water from the island is assumed to be by seepage through the sandy deposits along the east coast and possibly by undersea discharge elsewhere on the island. On the basis of present well yields, amount of freshwater inferred to be present below the water table, and potential recharge from precipitation, it is concluded that it should be possible to design a well field in the southeastern part of the island that could yield more than a million gallons per day without danger of inducing saline water into the well field. The water is of good chemical quality. (USGS)
W81-01033

DESIGNING IRRIGATION-CUM-DRAINAGE PONDS FOR ALKALI LANDS, Central Soil Salinity Research Inst., Karnal (India).

S. K. Gupta, and R. N. Pandey. Indian Journal of Agricultural Science, Vol 50, No 5, p 428-430, May, 1980. 1 Fig, 2 Tab, 2 Ref.

Descriptors: *Runoff, *Agricultural runoff, Rainfall disposition, *Alkali soils, *Drainage engineering, *Farm ponds, Rice, Storm runoff, Infiltration, Ponds, Surface drainage, Rainfall-runoff relation-

A water balance equation in which the amount of runoff is calculated from precipitation, evaporation, infiltration, depth of detention in crop fields, and duration of storm was used to design a dug-out pond to store storm drainage from rice-planted alkali lands. Although theoretical calculations suggested a 28.2 hectare-cm pond to drain a 6 hectare rice field, actual capacity was measured at 22 hectare-cm. Observed and predicted runoff data agreed closely. A pond capacity satisfactory for this region may be calculated, considering a storm of 2 days with a 10 year return period. Water stored in the ponds may be utilized for other purposes, thus producing additional capacity for storm runoff. As infiltration rates improve with land treatments, more storage is possible. (Cassar-FRC)

4B. Groundwater Management

GROUND-WATER APPRAISAL OF THE FISH-KILL-BEACON AREA, DUTCHESS COUNTY,

Geological Survey, Albany, NY. Water Resources For primary bibliographic entry see Field 2F.

SIMULATED WATER-LEVEL NEAR MARIENTHAL, WE KANSAS, DECLINES WEST-CENTRAL

Geological Survey, Lawrence, KS. Water Resources Div.

L. E. Duniap.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105272, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-39, April, 1980. 15 p, 7 Fig, 5 Ref.

Descriptors: *Groundwater, *Aquifers, *Model Descriptors: "Groundwater, "Aquiters, "Model studies, "Water table, "Kansas, Hydrogeology, Water levels, Irrigations, Pumping, Withdrawal, Mathematical models, Drawdown, Overdraft, Simulation analysis, Projections, Water management(Applied), Hydrographs, West-central Kansas, "Wichita County(KS).

Intensive study in an area of 12-square miles in northeastern Wichita County, Kansas, has shown a decrease of 30 to 50% in saturated thickness of the decrease of 30 to 50% in saturated thickness of the Ogallala Formation since the development of irrigation. Projections from a digital model indicated the additional water-level declines that might occur from 1978 to 1989 if the pumpage in the model area was assumed to be one-half, equal to r double the 1977 rate. The additional declines would range from 5 to 15 feet, 15 to 30 feet, and 25 to 40 feet, respectively. If pumpage only in the intensive-study area were assumed to be one-half or double the 1977 rate, water-level declines would range from 10 to 20 feet and from 20 to 25 feet, respectively. Reducing pumpage only in the intensive-study area could reduce the water-level declines locally. However, declines would be great-stear the red edge of the area as a result of continest near the edge of the area as a result of contin-ued pumpage by wells outside the area. The digital model was more sensitive to changes in pumpage than to changes in hydraulic conductivity, specific yield, or recharge. W81-01030

GEOLOGIC ASPECTS OF THE SURFICIAL AQUIFER IN THE UPPER EAST COAST PLANNING AREA, SOUTHEAST FLORIDA, Geological Survey, Tallahassee, FL. Water Resources Div. W. L. Miller.

Available from the OFSS, USGS Box 25425, Fed.

Ctr., Denver, CO 80225, Price: \$3.50 in paper copy, \$1.00 in microfiche. Geological Survey Open-File Report 80-586 (WRI), 1980. 2 Sheets, 9 Ref.

Descriptors: *Water management(Applied), *Geology, *Aquifers, *Groundwater, *Florida, Water utilization, Aquifer characteristics, Hydrogeology, Sediments, Planning, Maps, Contours, Cross-sections, *Southeast Florida, St. Lucie County(FL), Martin County(FL), Okeechobee County(FL)

The Upper East Coast Planning Area, as designated by the South Florida Water Management District, consists of St. Lucie County, Martin County, and eastern Okeechobee County. The surficial aquifer is the main source of freshwater for agricultural and urban uses in the area. The geologic framework of the aquifer is displayed by contour mapping and lithologic cross sections to provide water managers with a better understanding of the water imanagers with a octet understanding of the natural restraints that may be imposed on future development. The surficial aquifer is primarily sand, limestone, shell, silt, and clay deposited during the Pleistocene and Pliocene Epochs. The aquifer is unconfined and under water-table conditions in most of the area, but locally, artesian conditions exits where discontinuous clay layers act as confining units. Impermeable and semipermeable clays and marls of the Tamiami (lower meable clays and maris of the I amiami (lower Pliocene) and Hawthorn Formations (Miocene) unconformably underlie the surficial aquifer and form its base. Contour lines showing the altitude of the base of the aquifer indicate extensive erosion of the Miocene sediments prior to deposition of the aquifer materials. (USGS) W81-01038

AN ECONOMIC EVALUATION OF THE FEAS-IBILITY OF ARTIFICIAL GROUNDWATER RECHARGE IN NEBRASKA,

Nebraska Univ.-Lincoln. Dept. of Agricultural

For primary bibliographic entry see Field 6B. W81-01155

DIGITAL-SIMULATION AND PROJECTION OF HEAD CHANGES IN THE POTOMACRARITAN-MAGOTHY AQUIFER SYSTEM, COASTAL PLAIN, NEW JERSEY,

Geological Survey, Trenton, NJ. Water Resources

For primary bibliographic entry see Field 2F. W81-01185

SIMULATED EFFECTS OF A PROPOSED WELL FIELD ON THE GROUNDWATER SYSTEM IN THE SALT RIVER INDIAN RESERVATION, MARICOPA COUNTY, ARIZONA, Geological Survey, Tucson, AZ. Water Resources

For primary bibliographic entry see Field 2F. W81-01191

MAPS SHOWING SATURATED THICKNESS, JANUARY 1979, AND PERCENTAGE DE-CREASE IN SATURATED THICKNESS, 1950-79, OF UNCONSOLIDATED AQUIFER, WEST-CENTRAL, KANSAS,

Geological Survey, Garden City, KS. Water Re-

For primary bibliographic entry see Field 7C. W81-01195

4C. Effects On Water Of Man's Non-Water Activities

MANUAL OF PRACTICE ON URBAN DRAIN-

Environmental Protection Service. Ottawa (Ontario). Water Training and Technology Transfer Div. For primary bibliographic entry see Field 10D. W81-01021

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4C-Effects On Water Of Man's Non-Water Activities

MODELING THE RUNOFF PROCESS IN URBAN AREAS, Purdue Univ., Lafayette. School of Civil Engineer-

For primary bibliographic entry see Field 2A. W81-01153

4D. Watershed Protection

COSTS AND BENEFITS OF TERRACES FOR EROSION CONTROL,
Illinois Univ., Urbana-Champaign. Dept. of Agri-

J. K. Mitchell, J. C. Brach, and E. R. Swanson, Journal of Soil and Water Conservation, Vol 35, No 5, p 233-236, September/October, 1980. 6 Fig. 3 Tab. 9 Ref.

Descriptors: *Erosion control. *Terracing. *Costbenefit analysis, Feasibility studies, Farm management. Watershed management.

Terrace construction costs were estimated using 1978 data to determine whether terrace systems were economically justifiable to control erosion. were economically justifiable to control erosion. Field slopes between 1 and 15% using both the gradient and the tile-outlet-storage type of terrace were considered. All cost and yield considerations were spaced over a 20 yr period. It was determined that six factors affected the cost of the terracing system over the 20 yr; kind of subsoil, slope, type of terrace used, level of management, and soil erodibility. The cost of constructing terand soil erodibility. The cost of constructing terraces does not increase at a constant rate with increasing slope. A sharp reversal in the cost curve occurs at a slope of 6% because calculations for slopes of 6% or greater are based on the use of grass backslope terraces, thus reducing the effective field slope, allowing the terraces to be spaced farther apart. For any initial level of productivity, terrace systems are more costly for soils on favorable subscile than for these on unfavorable subscile. ble subsoils than for those on unfavorable subsoils. The highest net benefits are realized on slopes from 4 to 10% because the increases in losses due to erosion tend to cancel out the increased construction costs. The costs of tile-outlet terraces at var-ious levels of initial productivity were about \$130 more per acre than for gradient terraces at the end of the 20 yr. The study indicated that the only situation in which terracing increased farm income was when a gradient terrace system was used on highly erodible soils with unfavorable subsoils and at a high level of management. (Baker-FRC) W81-01062

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY OF COPPER(II) AT THE GLASSY CARBON ELECTRODE,

New Hampshire Univ., Durham, Dept. of Chemis-

try.
R. B. Smart, and J. H. Weber.
Analytica Chimica Acta, Vol 115, p 331-336, 1980.
3 Fig, 1 Tab, 18 Ref. OWRT-B-004-NH(4).

Descriptors: *Analytical techniques, *Copper, *Fulvic acids, *Assay, *Chemical analysis, *Water pollution, Contamination(Water), Metals, Organic acids, Organic compounds, Polarographic analysis, Analysis, Pollution(Water), Research and development, Estimating, Evaluation, Testing procedures, Measurement, Calibrations, Electrodes, Instrumen-Monitoring, Testing, Pollutants, Glassy carbon electrode.

The ultimate goal of this study was to use the glassy carbon electrode (GCE) for measurements of metal-complex conditional stability constants, and thus the effect of pH on the GCE response was examined. Also the use of the title technique (DPASV) for copper (II) in potassium nitrate solu-tion was tested to try to utilize lower plating times, yet maintain or improve the limit of detection of the linear scan technique. Detection limits were determined at different pH values, and the usual instrumental parameters were optimized. The DPASV of copper (II) at the GCE gave detection limits similar to those for the rotated GCE, but with much shorter plating times, offering the advantage of decreased analysis time. The GCE had been studied earlier for possible use in monitoring been studied earlier for possible use in monitoring copper (II) ions in a compleximetric titration of naturally-occurring organics in water since the GCE does not adsorb soil fulvic acids, but the two distinct linear regions for the copper (II) calibration curves at pH 4.5 and 6.5 would make it difficult to locate endpoints in such titrations. Also, deviations from linearity at higher copper (II) concentrations suggested that the GCE be used very carefully in these titrations. (Zielinski-IPA) W81-01010

ASBESTOS FIBRES IN RECEIVING WATERS. Department of the Environment, Vancouver (British Columbia). Pacific Region.

H. Schreier, and J. Taylor. Technical Bulletin No 117, 1980, 18 p. 7 Fig. 9 Tab, 63 Ref, 1 Append.

Descriptors: *Asbestos fibres, *Water supply, *Drainage systems, *Toxicity, Hydrologic cycle, Concentrations, Distributions, British Columbia, Water analysis, Water pollution, Asbestos, Evaluation. Public health. Hazards.

Little is known about asbestos fibre concentration Little is known about asbestos fibre concentration in water supplies and drainage systems and the possible health hazard which it could create. A comprehensive review of the subject is provided in this report, which includes results of exploratory studies in British Columbia and the Yukon, and a comparison with concentrations elsewhere in North America. Asbestos fibres, which can be introduced into the hydrologic system by natural and man-made processes, were reported in all phases of the hydrologic cycle. The greatest source appears to be natural exposures of asbestosbearing bed rock where the fibres are introduced source appears to be institute exposures of absence-bearing bed rock where the fibres are introduced by surface runoff as well as by groundwater drain-age. Levels of up to 10 billion fibres/L were measured in natural river systems in British Colum-bia; these results were significantly higher than those reported for drinking water supplies in eastern Canada and the eastern United States. The concentrations are comparable with those reported from mine effluents in Quebec and groundwater levels in New Mexico. Weathering processes and the abundance of asbestos-bearing metamorphic rocks in British Columbia are thought to be the main causes of these high concentrations. It is suggested that bedrock geology be used as a means suggested that bettock geology be used as a liceasis of predicting high asbestos concentrations in drainage systems. Finally, for a better understanding of the processes responsible for the asbestos fibre distribution in water systems, it is suggested that an investigation of the transport mechanisms be initi-ated and that the spatial and seasonal variation in a number of drainage systems be determined. WATDOC) W81-01013

INTERLABORATORY QUALITY CONTROL STUDY NO. 24, ANALYSIS OF EIGHT ACID HERBICIDES IN NATURAL FRESH WATER, Canada Center for Inland Waters, Burlington (On-

H. Agemian, and A. S. Y. Chau. Report Series No 67, 1980. 9 p, 4 Fig, 5 Tab, 8 Ref.

criptors: *Acid herbicides, *Freshwater, *Pes-Descriptors: Acid nerolicoses, "Freshwater, Freshwater, Freshtcide residues, Canadian laboratories, Quality control study, Water quality, Methodology, Standards, Herbicides, Acids, "Laboratory tests, "Analytical techniques, "Canada, Evaluation.

A national interlaboratory quality control study for Canadian laboratories on the determination of eight acid herbicides (MCPA; 2,4-DP; 2,4-DP; silvex; MCPB; 2,4,5-T; 2,4-DB; and picloram) in natural fresh water is described. The data show that most laboratories have acceptable expertise for the analysis of silvex; 2,4-5,T; and 2,4-D. No for the analysis of silvex; 2,4,5-T; and 2,4-D. No data were reported for MCPB by any laboratory, while only a few participants reported results on

MCPA; 2,4-DP; 2,3-DB; and picloram. The overall results indicate that most participants in this study had not attempted the analysis of all eight herbicides. This may reflect the limited expertise in multi-residue analysis of these herbicides in water at the designed concentrations. (WATDOC) W81-01016

WATER QUALITY OF BEAR CREEK BASIN, JACKSON COUNTY, OREGON, Geological Survey, Portland, OR. Water Resources Div. L. A. Wittenberg, and S. W. McKenzie. Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: \$16.75 in paper copy, \$3.50 in microfiche. Geological Survey Open-File Report 80-158 (WRI), 1980. 118 p, 26 Fig, 1 Plate, 24 Tab, 56 Ref.

Descriptors: "Water quality, "Oregon, "Irrigation canals, "Surface waters, "Streamflow, Return flow, Irrigation water, Water reuse, Water pollution sources, Sediments, Chemical analysis, Bactria, Biochemical oxygen demand, Dissolved oxygen, Hydrogen ion concentration, Nutrients, Coliforms, Water temperature, Dissolved solids, Aquatic life, Data collections, "Bear Creek basin(OR), "Jackson County(OR).

basin(OR), *Jackson County(OR).

Water-quality data identify surface-water-quality problems in Bear Creek basin, Jackson County, Oreg., where possible, their causes or sources. Irrigation and return-flow data show pastures are sources of fecal coliform and fecal streptococci bacteria and sinks for suspended sediment and nirtie-plus-nitrate nitrogen. Bear Creek and its tributaries have dissolved oxygen and pH values that do not meet State standards. Forty to 50% of the fecal coliform and fecal streptococci concentrations were higher than 1,000 bacteria colonies per 100 milliliters during the irrigation season in the lower two-thirds of the basin. During the irrigation season, suspended-sediment concentrations, average 35 milligrams per liter, were double those for the nonirrigation season. The Ashland sewage-treatment plant is a major source of nitrite plus mitrate, ammonia, and Kjeldahl nitrogen, and orthophosphate in Bear Creek. (USGS)

WATER-QUALITY ASSESSMENT OF THE PORTER COUNTY WATERSHED, KANKAKEE RIVER BASIN, PORTER COUNTY, INDIANA, Geological Survey, Indianapolis, IN. Water Resources Div. For primary bibliographic entry see Field 5B. W81-01035

MEASUREMENT OF MERCURY METHYLA-TION IN LAKE WATER AND SEDIMENT SAMPLES,

SAMPLES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
A. Furutani, and J. W. M. Rudd.
Applied and Environmental Microbiology, Vol 40, No 4, p 770-776, October, 1980. 3 Fig, 2 Tab, 38

Descriptors: *Mercury, *Microorganisms, *Radiochemical analysis, Analytical technique, Freshwater, Lake sediments, Water produces, Methylation, Ontario, Canada.

A new radiochemical technique was used to meas-A new radiochemical technique was used to meas-ure biological mercury methylation in the water column and sediments of Lake Clay (Ontario), a mercury contaminated lake. Samples were collect-ed and incubated, and the solvent extraction method developed by Uthe et al. was modified to extract radioactive, methylmercury produced extract radioactive methylmercury produced during incubation of the samples. Confirmation of methylation and testing to see that non-biological isotopic exchange was not responsible for methylation were performed. Over a period of 24 weeks, three episodes of methylating activity were detected in the surface floc and in water, each lasting three to five weeks. Periods of methylation in the water column coincided with surface sediment methylation and appeared to be related to overall microbial activity. Mercury was actively methylat-ed in the presence of bound sulfide. (Small-FRC) W81-01047

DIRECT POTENTIOMETRIC WATER HARDNESS DETERMINATION USING ION-SELEC-TIVE ELECTRODES,

Eidgenoessische Technische Hochschule, Zurich (Switzerland). Dept. of Organic Chemistry. P. C. Meier, D. Erne, Z. Cimerman, D. Ammann, and W. Simon.

Mikrochimica Acta, Vol 1, No 5/6, p 317-327, 1980. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Electrodes, *Hardness(Water), *Assay, Magnesium, Calcium, Water properties, Analytical techniques.

The use of ion-selective electrodes in water hardness determination was evaluated by determining those factors which bear on the measurement of the sum of concentrations of magnesium and calcium. The effects of these factors on the accuracy cium. The effects of these factors on the accuracy and precision of the assay were determined. To be competitive with other techniques, direct potentiometric water hardness determinations using ion selective electrodes must be restricted to relatively soft waters. The selectivity factor for magnesium, calcium, and sodium must be within 1.1% of unity if a hardness of 10 degree on the German scale is to be measured to within 0.1 degrees in the composition range of magnesium to calcium, conceptration tion range of magnesium to calcium concentration ratios of 0.25 to 25. (Small-FRC) W81-01051

THE EFFECT OF SURFACTANTS, CATIONS, AND COMPLEXING AGENTS ON THE SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM AMOUNTS OF URANIUM IN WATERS,

Australian Atomic Energy Commission Research Establishment, Lucas Heights.

Mikrochimica Acta, Vol 1, No 5/6, p 339-344, 1980. 1 Tab, 5 Ref.

Descriptors: *Uranium radioisotopes, *Spectro-photometry, *Water analysis, Surfactants, Cations, Heavy metals, Chelation.

(2-(5-bromo-2-pyridylazo)-5diethyl-aminophenol) was used for the determina-tion of uranium in the presence of surfactants, tion of uranium in the presence of surfactants, cations, and complexing agents in natural waters. Cationic, anionic, and non-ionic detergents, phosphate, soap, citric acid, Alamine-336, and mineral oil at concentrations of 100 mg/liter did not interfere in the determination of uranium. Iron(III), copper(III), chromium(III), and vanadium(V) gave additive errors but did not invanadum(V) gave additive errors but did not in-terfere when present in the usual concentrations found in natural waters. Sodium tripolyphosphate (100 ml) and sodium pyrophosphate (20 mg/liter) interfered badly, but a recovery rate of 98% was realized with the addition of 2 mg of thorium. Uranium can be detected at concentrations of 20 micrograms per liter in fresh water and 60 micrograms per liter in salt water if the water is not grossly contaminated with heavy metals. (Small-FRC) W81-01052

CONCENTRATION AND DETERMINATION OF ORGANIC ACIDS IN COMPLEX AQUEOUS SAMPLES,

Ames Lab., IA.
J. J. Richard, C. D. Chriswell, and J. S. Fritz. Journal of Chromatography, Vol 199, p 143-148, 1980. 5 Fig, 4 Ref.

Descriptors: *Pollutant identification, *Analytical techniques, *Anion exchange, Gas chromatography, Mass spectrometry, Flame photometry, Organic acids, Rivers, Running waters, Water pollution, Separation techniques, Anaerobic digestion, Waste water, Shales, Oil shales

Concentration by anion exchange with subsequent elution, esterification, and gas chromatography (GC) is used to analyze water samples from a municipal anaerobic digester, river water and oil shale process water for acidic constituents. After extraction of the acidic sample solutes by anion exchange, neutral organic solutes can be concentrated and determined by conventional resin concentration-GC methods. Compounds identified in the water from the anerobic digester included: henzoic acid, caprylic acid, m-toluic acid, phenyla-cetic acid, phenylpropionic acid, 3,5-dimethylben-zoic acid, capric acid, B,B-dimethylphenylacetic acid, phenylbutyric acid, MCPP, myristic acid, palmitic acid, abietic acid, 2,4-D, DCPA, and 2,4dichlorophenol. Compounds identified in the water samples taken from the Skunk River included: benzoic acid, lauric acid, myristic acid, palmitic acid, and stearic acid. The shale oil water samples acid, and stearic acid. In e snale oil water samples had a high organic content which appeared to contain very large numbers of complex organic compounds. A considerable number of acidic sulfur compounds were present. The other major compounds appeared to be lower molecular weight carboxylic acids and aromatic acids. Thus weight carousyne actus and aromatic actus. Into the anion-exchange preconcentration procedure followed by esterification and GC analysis works well for a variety of complex aqueous samples. The method is preferable to solvent extraction for concentrating and measuring organic acidic components of water samples. (Baker-FRC)
W81-01067

CONCENTRATION AND DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN AQUEOUS SAMPLES ON GRAPHITIZED CARBON BLACK,

ILZED CARBUN BLACA, Rome Univ. (Italy). Ist. di Chimica Analitica. A. Lagana, B. M. Petronio, and M. Rotatori. Journal of Chromatography, Vol 198, No 2, p 143-149, October, 1980. 2 Fig. 3 Tab, 32 Ref.

*Chromatography, *Adsorption, Descriptors: Descriptors: "Adsorption, "Chromatography, 'Aromatic compounds, Analytical techniques, Separation techniques, Water pollution, Organic compounds, Carbon, Rivers, Potable water, Sol-vents, Water analysis, Molecular structure, Curves.

Polycyclic aromatic hydrocarbons (PAH) are among the compounds for which the US EPA must set maximum limits in effluent waters. Since PAHs often occur in very low levels in water samples, a concentration step is often necessary before analysis. Graphitized carbon black (GCB) has been reported to have a high sorption capacity for certain organic micropollutants. GCB was tested as a concentration device for PAHs prior to liquid chromatography. Various GCB solvent systems (toluene, benzene, dichloromethane, acetonitrile, n-hexane and water) were each spiked with 6 different PAH compounds to estimate partition coefficients and percent recovery of the PAHs. Break-through plots were generated from samples Break-through plots were generated from samples of drinking water or river water to which the PAHs had been added and that were run through the GCB column prior to PAH analysis by high pressure liquid chromatography. Fluoranthen showed different retention and break-through volumes in river and drinking water suggesting the importance of the aqueous system used. Satisfactory recoveries of PAH were obtained using GCB concentration procedures when the composition of the water was considered. Molecular structure of the PAH also affects the efficiency of GCB recov-ery. The toluene-benzene-acetonitrile (5:2:3) solvent system was also found to give good results for PAH recovery by the GCB method. (Geiger-W81-01068

TRACE ELEMENTS IN WATER AND BIO-

IRACE ELEMENTS IN WALER AND BIT LOGICAL SAMPLES DETERMINED BY 3 RAY SPECTROSCOPY, Institut Rudjer Boskovic, Zagreb (Yugoslavia). A. Ljubicic, I. Orlic, V. Valkovic, B. Bek, and S. Holjevic.

Progress in Water Technology, Vol 12, No 4, p 513-522, 1980. 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Trace elements, *Water analysis, *X-ray spectroscopy, Chemical analysis, Analytical techniques, Marine animals, Sea water.

Concentrations of trace elements in sea water. drinking water, and marine organisms were determined simultaneously by X-ray spectroscopy. Sensitivities of methods involving three sources of radiation were compared. The proton method using MeV protons from a Van de Graaff accelerator exhibited the highest sensitivity. X-rays from the Mo-tube produced less sensitive results. Howne mortuse produced less sensitive results. How-ever, proper choice of fluorescers can increase sensitivity. It is suggested that larger samples be used in the least sensitive method, whose radiation source is Fe55 and Cd109. (Cassar-FRC) W31-01077

ANALYZING FOR TRACE CHEMICALS IN WATER: A MANAGER'S GUIDE,

D. W. Clark. Public Works, Vol 111, No 11, p 85-89, November,

Descriptors: *Analytical techniques, *Metals, Organic compounds, *Water analysis, *Trace elements, Spectroscopy, Testing procedures

Commonly used techniques for analysis of trace contaminants in water are summarized and their advantages and weaknesses discussed. Trace metals may be concentrated by ion exchange, evaporation, solvent extraction, and freezing. Analytical methods described are atomic absorption, spectrophotometry, polarography, and neutron activation analysis. Organic compounds may be concentrated by the same methods used for metals, as well as by by the same methods used for metals, as well as by activated carbon absorption. Gas chromatography, mass spectroscopy, and infrared spectroscopy are widely used to characterize and quantify these compounds. (Cassar-FRC) W81-01085

A VARIABLE-DEPTH GROUND-WATER SAM-PLER, Rhode Island Univ., Kingston. Dept. of Plant and

Soil Science.
C. G. Galgowski, and W. R. Wright

Soil Science of America Journal, Vol 44, No 5, p 1120-1121, September/October, 1980. 1 Fig. 8 Ref.

Descriptors: *Sampling, *Groundwater, Well casings, Water sampling, Aquifer testing, Water pollution, *Water wells, Instrumentation, Depth sampling, *Water analysis.

A variable-depth ground water sampler for 4 centimeter well casing pipe is described. This sampler, made from inexpensive materials, is adaptable to other sizes of well casings. It can extract water samples at any depth to a theoretical limit of 10 meters. Therefore, only one well is needed to meters. Therefore, only one well is needed to sample pollutants at various depths in an aquifer. Construction materials include plastic tubing, rubber stoppers, bicycle inner tubing, hose clamps a pressure gauge, 1 liter sample bottle, and a lead weight. By inflating the bicycle tubing, the intake tube can be located at any desired level in the casing. (Cassar-FRC) W81-01088

RELATIONSHIP OF POLLUTION TO ROCKY SUBSTRATUM POLYCHAETES OF FRENCH MEDITERRANEAN COAST.

Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.

G. Bellan.

Marine Pollution Bulletin, Vol 11, No 11, p 318-321, November, 1980. 5 Fig, 3 Tab, 6 Ref.

Descriptors: *Bioindicators, *Annelids, *Rocks, *Coasts, Water pollution effects, Industrial wastes, Municipal wastes, Outfall sewers, Mediterranean,

Polychaetous annelids were studied in the area of the Mediterranean coast east of Marseille where the municipal sewer discharges and along the coast the municipal sewer discharges and along the Coast east of the Gulf of Fos, a heavily industrialized port. At different levels of different types of pollutants the distribution of polychaetes in the various rocky biotopes in the upper part of the infralittoral zone showed great qualitative homogeneity. About 15 species accounted for more than 90% of the collected individuals. The Annelid Index of pollu-tion is presented, an index well correlated with the degree of pollution, as well as the Shannon-

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A-Identification Of Pollutants

Weaver diversity index. Indicator organisms for pollutants (Capitella capitata, Doreillea rudolphii, and others) are opposed to sentinel or detector organisms, which are indicators of pure water. The ratio of the sums of the dominances of these two species groups will furnish the Index. (Small-FRC) W81-01099

PHOTOLYSIS OF 3,4-DICHLOROANILINE IN NATURAL WATERS, Nevada Univ., Reno. Div. of Biochemistry. G. C. Miller, R. Zisook, and R. Zepp. Journal of Agricultural and Food Chemistry, Vol 28, No 6, p 1053-1056, November/December, 1980. 4 Fig. 4 Tab, 15 Ref.

Descriptors: *Photolysis, *3,4-Dichloroaniline, *Agricultural runoff, *Herbicides, Pesticide resi-dues, Water pollution, Tetrachloroazobenzene, *Solar radiation, Humic acids, Pesticides, Pollutants. Irradiation.

Sunlight irradiation of 3,4-dichloroaniline (DCA) in natural water samples from three rice fields, the Sacramento River, and an alfalfa irrigation ditch resulted in both direct and sensitized photoreacresulted in both direct and sensitized photoreac-tions. A humic acid solution, used as a model natural water, exhibited sensitizing factors similar to those of natural waters. The photolysis rate in irradiated samples of distilled water containing 3.4-dichloroaniline was slower than in natural waters. Formation of 3,4,3'4'-tetrachloroazobenzene, which is similar to TCDD (2,3,7,8-tetrachlorodi-benzo-para-dioxin) in structure and toxicological properties, was detected in DCA solutions in natuwaters and humic acid solutions, but not in distilled water. Pollutants in natural waters may sensitize photolysis of DCA and may promote different photoproducts. (Cassar-FRC) W81-01101

AUTOMATIC SEWAGE SAMPLERS: WHAT TO LOOK FOR WHEN BUYING, EG and G Washington Analytical Services Center, Inc., Rockville, MD.
P. E. Shelley.
American City and County, Vol 95, No 10, p 35-38, October, 1980. 3 Tab.

Descriptors: *Automation, *Water sampling, Waste water, Sewage, Equipment, Water quality, Reviews, Costs, Water analysis.

Increasing legislation for water quality has necessitated improved methods for rapid and accurate wastewater sampling. Some guidelines are offered to aid in choosing the proper automatic sewage sampler from among the many models that are currently marketed. The most important consideration in selecting an automatic wastewater sampler is the type of sample that is desired. A brief review of several sample types including discrete samples, simple composite samples, flow proportional composite samples, sequential composite samples and continuous composite samples is presented. Secontinuous composite sampies it presented. Sequential discrete sampling is generally desired for initial characterization of wastewater flows, and is generally required for stormwater sampling. In addition to twelve main considerations in the selection of an automatic liquid sampler, the equipment should be designed for easy maintenance and quick troubleshooting. An extensive summers of compoler should be designed for easy maintenance and quick troubleshooting. An extensive summary of sampler characteristics gives data on the type of collection method used, the flow rate, line velocity and size, lift, sample type, type of installation, cost range, and power required for each unit. The wastewater sampler should be constructed of corrosion-resistant material that is easy to clean. Rapid changes in the automatic liquid sampler field are discussed along with the different sample gathering subsystems, which include suction lifts, vacuum pumps, pneumatic ejection, evacuated bottles and mechanical devices. A listing of automatic liquid sampler manufacturers in the United States and their addresses is also given. (Geiger-FRC) addresses is also given. (Geiger-FRC) W81-01103

DETERMINATIONS OF TRACE AMOUNTS OF 9,10-ANTHRAQUINONE IN AQUEOUS SYSTEMS BY DIFFERENTIAL PULSE POLAR-OGRAPHY.

Trondheim Univ. (Norway). Dept. of Chemistry. J. O. Bronstad, K. H. Schroder, and H. O. Friestad.

Analytica Chimica Acta, Vol 119, No 2, p 243-249, 1980. 2 Fig, 11 Ref.

Descriptors: *Polarographic analysis, *Pollutant identification, Analytical techniques, 9,10-Anthra-quinone, Water pollution, *Pulp wastes, Pulp and paper industry.

A differential pulse polarographic method for the determination of 9,10-anthraquinone is presented. The detection limit of the method is about 2 microg/ml with a standard deviation of 2.4%. The polarographic behavior of 9,10-anthraquinone is polarographic benavior of yt.0-antifraquinone is very sensitive to and thus dependent upon the nature of the solution and the supporting electrolyte. The most satisfactory results were obtained using 0.1 mg/l tetrabutylammonium tetrafluoroborate dissolved in methanol. Two methods are presented; one is used for cases in which strongly contaminated samples are to be analyzed. For determination of 9,10-anthraquinone in relatively pure substances such as natural waters, a direct extraction procedure with chloroform is recommended. Interfering compounds in the more com-plex samples are removed by a modified procedure involving steam distillation and extraction. (Baker-FRC) W81-01106

EFFICIENCIES OF LIQUID-LIQUID EXTRACTION AND XAD-4 AND XAD-7 RESINS IN COLLECTING ORGANIC COMPOUNDS FROM A COKE PLANT'S EFFLUENT, Illinois Environmental Protection Agency, Spring-

D. J. Schaeffer, D. C. Tigwell, S. M. Somani, and K. G. Janardan.

Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 569-573, October, 1980. 2 Tab, 7 Ref.

Descriptors: *Water analysis, *Waste water pollu-tion, *Sampling, *Organic compounds, *Coke plant effluents, Chemical analysis, Ion exchange resins, Separation techniques, Resins, Ion exchange, Industrial wastes, Effluents

Waste water from a coke plant was analyzed by gas chromatography and mass spectrometry to identify organic compounds and to determine the efficiency of collection methods: liquid-liquid extraction, XAD-4 and XAD-7 resins. The two resins recovered about 40 compounds each at 75% efficiency. By combining the two resins, 63 com-pounds were identified. Liquid-liquid extraction recovered 90 compounds at 65% efficiency. Using either resin with liquid-liquid extraction recovered about 110 compounds with efficiencies varying from 58.6 to 76.8%. When the total acid fractions were derivatized, 132 to 136 compounds were ob-served. Efficiency of collection varied from 63.8 to 97.1%. These results suggest that the characterization of complex wastes requires simultaneous col-lection of samples by several methods. (Cassar-FRC) W81-01112

MUSSELS (MYTILUS EDULIS) AS 'POINT SOURCE' INDICATORS OF TRACE METAL POLLUTION,

POLLUTION, Simon Fraser Univ., Burnaby (British Columbia). Dept. of Chemistry. J. D. Popham, D. C. Johnson, and J. M. D'Auria. Marine Pollution Bulletin, Vol 11, No 9, p 261-263, September, 1980. 2 Fig, 9 Ref.

Descriptors: *Mussels, *Water pollution sources, *Outfall sewers, *Trace elements, Marine animals, Lead, Copper, Zinc, Vancouver(Canada), Burrard Inlet(Canada), Harbors, Storm drains, Metals,

The common blue mussel, Mytilus edulis, was used as an indicator organism in a line transect study to locate within 30 meters a point source discharge of trace metals. Mussels close to a storm water outfall in the port of Vancouver, Canada, showed high levels of copper, zinc, and lead, while those only

30 meters away had baseline levels. A large differ-30 meters away nad basenne levels. A large difference in concentration of trace metals in mussels collected from different sides of one wharf was explained in that the wharf acts as a barrier against mixing of storm drainage water with sea water. The finding that trace metal concentrations in mussels decrease rapidly with distance from a point sets decrease raphity with unstance from a point source indicates that mussels can be used to locate precisely (within 30 km) a point source discharge of trace metals. (Cassar-FRC) W81-01115

TAXONOMY, POLLUTION AND SLUDGE WORM,

Institute of Ocean Sciences, Sidney (British Columbia). Ocean Ecology Lab. R. O. Brinkhurst.

Marine Pollution Bulletin, Vol 11, No 9, p 248-251, September 1980

Descriptors: *Bioindicators, *Sludge worms, *Oligochaetes, Toxicity, Systematics, Reviews, Biological communities, Water pollution.

This essay on the taxonomy of worms used as bioindicators of pollution discusses the various species of oligochaetes. Although there are about 1000 species known, biologists only have to identify 20 to 30 species on a global basis and only one or two dozen in any habitat type. M ost of the interest in pollution biology deals with field detection methods rather than physiological/toxicological ap-proaches. Family level is usually used rather than species. The development of diversity indexes and the study of toxicology have led to the expansion of interest in worms. The first world meeting of specialists was held in 1979 and included reports on sludge worm taxonomy, evolution, zoogeo-graphy, toxicology, life histories, and niche dis-crimination. (Small-FRC)

GAS CHROMATOGRAPHY COMBINED WITH MASS SPECTROMETRY FOR THE IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS IN SHELLFISH AND FISH,

Okayama Univ. (Japan). Dept. of Public Hygiene. For primary bibliographic entry see Field 5C. W81-01123

PSYCHROPHILES, PSYCHROTROPHS, AND MESOPHILES IN AN ENVIRONMENT WHICH EXPERIENCES SEASONAL TEM-PERATURE FLUCTUATIONS,

Laurentian Univ., Sudbury (Ontario). Dept. of Bi-

ology. G. D. Ferroni, and J. S. Kaminski. Canadian Journal of Microbiology, Vol 26, No 10, p 1184-1191, October, 1980. 9 Tab, 9 Ref.

Descriptors: *Microorganisms, *Sediment-water interfaces, *Temperature, Seasonal, Bacteria, Lakes, Canada.

Psychrophilic/psychrotrophic and mesophilic, heterotrophic bacteria were quantified in sediment-water interface samples from a lake which experirences seasonal temperature fluctuations. The psychrophilic/psychrotrophic population ranged from 1212 to 87,000 per ml, and the mesophilic population ranged from 67 to 3783 per ml over the population ranged from 67 to 3783 per ml over the yearly cycle. Pyschrophilic/psychrotrophic bacteria predominated on every sampling occasion. A considerable number of isolates at 37 C were psychrotrophs with broad temperature ranges for growth. A total of 388 isolates were determined and were grouped into 158 working types based on Gram reaction, colony and cell morphology, biochemical activities, and thermal type. (Small-FRC)

EVALUATION OF STEADY-STATE-BIOFILM

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering. B. E. Rittmann, and P. L. McCarty. Biotechnology and Bioengineering. Vol 22, No 11, p 2359-2373, November, 1980. 6 Fig. 20 Ref.

Sources Of Pollution—Group 5B

Descriptors: *Kinetics, *Organic matter, *Microorganisms, Impaired water quality, Waste water(Pollution), Laboratory tests.

The results of an experimental evaluation of the steady-state model of biofilm kinetics and the conseasy-state motor of brothin kinetics and the con-cept of minimum substrate concentration are pre-sented. With acetate as the growth medium in laboratory-scale biofilm reactors, the steady-state concept of minimum substrate concentration was concept of minimum substrate concentration was verified for naturally grown biofilms. As the substrate reached the minimum substrate concentration (0.66 mg/liter for acetate), substrate removal and biofilm thickness declined rapidly. The model successfully predicted substrate utilization and biofilm thickness using independently derived binetic film thickness using independently derived kinetic parameters. The results indicate that organic materials may persist in water and waste water partially because they are in too low concentration to supply sufficient energy to sustain the microorgan-isms. (Small-FRC) W81-01125

DETERMINATION OF THE AQUEOUS SOLU-BILITIES OF ORGANIC LIQUIDS AT 10.0, 20.0, AND 30.0 C BY ELUTION CHROMATO-GRAPHY,

National Bureau of Standards, Washington, DC. National Measurement Lab. F. P. Schwarz, and J. Miller. Analytical Chemistry, Vol 52, No 13, p 2162-2164, November, 1980. 3 Tab, 14 Ref.

Descriptors: *Organic compounds, *Solubility, *Chromatography, Solvents, Aqueous solutions, Analytical techniques, Spectrophotometry, Temperature, Toxins, Path of pollutants, Water pollution, Aromatic compounds, Pollutant identifica-

To better understand the fate and solubility prop-To better uncerstand the late and solubility properties of foxic organics in the aquatic environment, the solubilities of several organic liquids were determined at various temperatures by elution chromatography. Aqueous solubilities of cholorbenzene, m-dichlorobenzene, diethyl phthalate, dibutyl phthalate, toluene, 1,1,1-trichloroethane and phthalate, tollene, 1,1,1-trichloroethane and 1,1,2,2-tetrachloroethane were determined at 10.0, 20.0, and 30.0 C. Aqueous solubilities of ethylbenzene and o-dichlorobenzene were determined at 20.0 and 30.0 C. Results from the benzene deriva-200 and 300 C. Results from the benzene deriva-tives were compared with those determined by UV absorption measurements made on the solution phase. Of the nineteen benzene solubilities deter-mined by elution chromatography, fifteen were in agreement with results obtained by UV absorption within an experimental error of 4%. Elution chromatography results for the chloroethane deriva-tives were in even closer agreement with aqueous solubilities measured by UV absorption, with an experimental error of 2%. Solubilities recorded ranged from 0.0011 w/% for dibutyl phthalate at 20.0 C to 0.385 wt% for 1,1,2,2-tetrachloroethane at 20.0 C. (Geiger-FRC)

A WELL-HEAD INSTRUMENT PACKAGE FOR MULTI-PARAMETER MEASUREMENT DURING WELL WATER SAMPLING,

California Univ., Livermore. Environmental Sciences Div

ences DIV. G. Garvis, and D. H. Stuermer. Water Research, Vol 14, No 10, p 1525-1527, October, 1980. 3 Fig, 4 Ref.

Descriptors: *Design criteria, *Groundwater, *Water wells, Data collections, Monitoring, Water sampling, *Water analysis, Well data, Design data, Wells, Water pollution, Data transmission, Measurement, Sampling, Hydrogen ion concentration, Oxidation-reduction potential, Conductivity, Temperature

A new design for a portable well-head instrument package improves groundwater sampling and con-tinuous monitoring of pH, redox potential, conductivity and temperature. These parameters are considered useful indicators of possible contamination from the well itself. The new instrument consists of probes attached to the well-head and connected to digital display meters housed in a separate insulat-

ed carrying case. This system has been used in several monitoring programs. It functions reliably, is convenient and improves the accuracy of pH and redox potential measurements. (Titus-FRC) W81-01138

SEDIMENT OXYGEN DEMAND TECHNIQUES: A REVIEW AND COMPARISON OF LABORATORY AND IN SITU SYSTEMS, Wisconsin Univ., Madison. Lab. of Hygiene. G. T. Bowman, and J. J. Delfino. Water Research, Vol 14, No 5, p 491-499, May, 1980. 3 Fig. 10 Tab. 56 Ref.

Descriptors: *On-site laboratories, *Analytical techniques, *Sediments, *Water analysis, *Chemcial oxygen demand, Testing procedures, Water pollution, Laboratory tests, Materials testing, Dissolved oxygen, Water measurement, Sampling, In-

Sediment oxygen demand measurement techniques are reviewed and improvements are recommended. In comparisons of data from among two or more techniques, methodological differences were identified as the greatest source of variations. Five principal analytical systems are used to evaluate sediment oxygen demand: (1) batch, which includes laboratory and in situ; (2) continuous flow; (3) manometric; (4) electrolytic; and (5) dehydrogenase activity. Comparison of methods requires establishment of criteria to determine whether the establishment of referral to determine whether the methods are acceptable. These criteria are: (1) consistency; (2) reproducibility; and (3) efficiency. Laboratory techniques meet the criteria more read-ily than in situ techniques, because many factors including temperature, turbidity, light, and current velocity cannot be controlled in situ. A sediment oxygen demand reaction chamber has been designed and meets the criteria. It gives an optimum volume to surface ratio and provides results in less than 24 hours. Based on experiments, the 24 hour period decreases the possibility of error due to initial chemical oxygen demand. (Titus-FRC) W81-01149

CHEMICAL AND SPECTROSCOPIC CHARACTERIZATION OF HUMIC SUBSTANCES DERIVED FROM RIVER SWAMPS IN THE FLOOD PLAINS OF SOUTHEASTERN U.S. COASTAL STREAMS, Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.

J. H. Reuter.

A wailable from the National Technical Information

J. H. Reuter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150245, Price codes: A05 in paper copy, A01 in microfiche.
Environmental Resources Center, Georgia Institute of Technology, Project Completion Report ERC 06-08, September, 1980. 66 p, 16 Fig, 11 Tab, 23 Ref. OWRT-B-132-GA(1).

Descriptors: *Chemical analysis, *Spectroscopy, *Soil analysis, *Humic acids, *Fulvic acids, *Swamps, *Flood plains, Coasts, Instrumentation, Nutrients, Analysis, Decomposing organic matter, Organic soils, Acids, Organic compounds, Chelation, Wetlands, Humus, Trace elements, Soil chemical properties.

Samples were taken from surface peat from the Okefenokee swamp, from surface soils and sediment cores in the Altamaha flood plain, and analyzed. Several distinct fractions of river swamp system. Several unsuffer fractions of river swamp related humic substances were identified by chemical/spectroscopic methods. The results showed that humic substances are abundantly synthesized in river swamps and are both stored in soils and exported into the overlying or percolating waters. Water-soluble humus derived from peta appeared water-solution number derived from pear appeared to be of a lower degree of humification and condensation than both the aquatic humus from swamp waters and swamp soil fluive acids (FA), and may hence be a chemical precursor of both. Aquatic humus resembled soil FA in chemical composition and acidic functional group content. (AFGC). Relative to 'average' soils, swamp soils were depleted in low molecular weight FA, probably due to intensive percolation by flood waters. Data on soil humic acids (HA) and FA abundance and their AFGC were used to estimate metal-

binding capacities of the swamp soil due to humic substances. Metal-binding studies with swamp soil HA and FA confirmed their ability to complex potential pollutant metals. (Zielinski-IPA) W81-01158

A STATISTICAL ANALYSIS OF THE QUALITY OF SURFACE WATER IN NEBRASKA, Geological Survey, Lincoln, NE. Water Resources nary bibliographic entry see Field 7C.

5B. Sources Of Pollution

ASBESTOS FIBRES IN RECEIVING WATERS. Department of the Environment, Vancouver (British Columbia). Pacific Region. For primary bibliographic entry see Field 5A. W81-01013

ST. LAWRENCE RIVER WATER QUALITY

SURVEYS, 1977, Canada Centre for Inland Waters, Burlington (On-

C. H. Chan. Scientific Series No 113, 1980. 16 p, 17 Fig, 3 Tab, 9 Ref.

Descriptors: *Water quality, Nutrients, *Surveys, Mean concentrations, Physical parameters, Ions, Metals, *St. Lawrence River, Sampling, Surveys, Data collection, Polychlorinated biphenyls, Water Dellution sources, *Path of pollutants, International

Six water quality surveys were carried out in 1977 on the international section of the St. Lawrence River. Results compared with 1973-1974 data showed no apparent change in the water quality of the river. Nutrient concentrations (nitrate and phosphorus) increased progressively downstream, phosphorus) increased progressively downstream, especially downstream from Brockville. High inputs of metals from United States tributaries were found in areas of the St. Lawrence below Massena. High levels of PCB were detected in the Grass River. (WATDOC) W81-01014

STATISTICAL ANALYSES OF SURFACE-WATER-QUALITY VARIABLES IN THE COAL AREA OF SOUTHEASTERN MONTANA. Geological Survey, Helena, MT. Water Resources

J. R. Knapton, and R. F. Ferreira. J. N. Khappion, and K. F. Ferreira.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-226020,
Price codes: A07 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations
80-40, June, 1980. 128 p, 2 Fig. 4 Tab. 17 Ref.

Descriptors: *Water quality, *Streams, *Montana, Coal mines, *Chemical analysis, Anions, Cations, Dissolved solids, Specific conductivity, Trace elements, Sediment transport, Water temperature. Path of pollutants, Water utilization, Irrigation, Cattle, Water analysis, Evaluation, *Southeastern Montener.

Since 1974 a network of water-quality stations has been operated in the coal area of southeastern Montana. This report updates a previous report with 2 years of additional data collection and prewith 2 years of additional data collection and pre-sents statistics and regression equations for water-quality variables. The most apparent feature of the study is the variability of water quality. Time-trend differences are most noticeable, with areal differ-ences being present but more subtle. In comparing stations at the mouths of the five major drainages entering the Yellowstone River from the study area, water from the Powder River ranks near the middle of the group in dissolved solids concentraarea, water from the Powder River ranks near the middle of the group in dissolved-solids concentration (mean of 1.390 mg/L), but far exceeds the other drainages in suspended-sediment concentration, often exceeding 10,000 mg/L. The Tongue River generally has the best overall quality with respect to dissolved constituents; extremes are moderated by mixing in the Tongue River Reservoir.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources Of Pollution

Suspended sediment ranged from 5 to 4,360 mg/L. Rosebud Creek shows about a 50-percent average increase in dissolved-solids concentration from the increase in dissolved-solids concentration from the most upstream station to the mouth. Armells and Sarpy Creeks, smallest of the five drainages, have a pool-riffle configuration that influences both dissolved and suspended constituents. Pools permit greater evaporation, thus increasing dissolved-constituent concentrations. They also act as sediment traps. (USGS) W81-01023

A ONE-DIMENSIONAL, STEADY-STATE, DIS-SOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR LITTLE LAUGHERY CREEK, RIPLEY AND FRANK-LIN COUNTIES, INDIANA, IN MOTE PARTIES OF THE PROPERTY OF THE PROPER

Geological Survey, Indianapolis, IN. Water Resources Div

C. G. Crawford, W. G. Wilber, and J. G. Peters Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: \$9.00 in paper copy, \$3.50 in microfiche. Geological Survey Open-File Report 80-74, January, 1980. 64 p, 24 Fig, 11 Tab, 57 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimulative capacity, *Water quality, *Indiana, Streams, Streamflow, Low flows, Reaeration, Water pollution, Waste water disposal, Waste water treatment, Biochemical oxygen demand, Ni-trification, Ammonia, Nitrates, Nutrients, Math-ematical models, *Ripley County(IN), *Franklin County(IN), Little Laughery Creek(IN).

A digital model calibrated to conditions in Little Laughery Creek triutary and Little Laughery Creek triutary and Little Laughery Creek, Ripley and Franklin Counties, Ind., was used to predict alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditions, summer and winter low flows. Natural streamflow during the summer and annual 7-day, 10-year low flow is zero. Headwater flow upstream from the wastewater-treatment facilities consists solely of process cooling water from an industrial discharger. This flow is usually less than 0.5 cubic foot per second. Consequently, benefits from dilution are minimal. As a result, current and projected ammonia-nitrogen concentrations from the municipal discharges will result in in-stream ammonia-nitrogen concentrations that A digital model calibrated to conditions in Little exceed the Indiana ammonia-nitrogen toxicity standards (maximum stream ammonia-nitrogen concentrations of 2.5 and 4.0 milligrams per liter concentrations of 2.5 and 4.0 milligrams per liter during summer and winter low flows, respectively). Benthic-oxygen demand is probably the most significant factor affecting Little Laughery Creek and is probably responsible for the in-stream dissolved-oxygen concentration being less than the Indiana stream dissolved-oxygen standard (5.0 milligrams per liter) during two water-quality surveys. After municipal dischargers complete advanced ngranis per niery during two water-quality surveys. After municipal dischargers complete advanced waste-treatment facilities, benthic-oxygen demand should be less significant in the stream dissolved-oxygen dynamics. (USGS) W81-01025

WATER RESOURCES OF BOULDER COUNTY, COLORADO.

Geological Survey, Denver, CO. Water Resources

Div. D. C. Hall, D. E. Hillier, D. Cain, and E. L. Boyd. Available from the Colo. Geol. Survey, 1313 Sherman St., Denver, CO 80202, Price: \$8.00 in paper copy. Colorado Department of Natural Resources Bulletin 42, 1980. 97 p, 19 Fig, 1 Plate, 23 Tab, 56

Descriptors: *Water resource, *Colorado, *Water quality, *Groundwater, *Surface waters, Streamflow, Precipitation(Atmospheric), Evapotranspiratiow, Precipitation(Atmospheric), Evapotranspira-tion, Surface runoff, Hydrogeology, Water wells, Aquifers, Aquifer characteristics, Water yield, Water table, Water quality standards, Septic tanks, Water pollution sources, Hydrologic data, *Boul-der County(CO), South Platte River basin(CO), Front Range Urban Corridor(CO).

Surface water is abundant in Boulder County Colo., because large amounts of precipitation fall

in the higher mountains and this precipitation feeds the streams directly or indirectly throughout the the streams directly or indirectly throughout the year. Ground water is an important source of water mostly for domestic, stock, or limited-acreage irrigation needs. The most frequently used aquifers are flood plain, terrace, Laramie-Fox Hills, Pierre-Niobrara-Benton, and crystalline rock. Median well yields of 15 or more gallons per minute occur for the flood plain, terrace, and Laramie-Fox Hills aquifers. The chemical and bacterial quality of the surface water is best at higher altitudes and decreases as the streams flow easterly to the plains and leave the county. The changes in water quality are influenced by the hydrogeology and the activities of man such as mining, farming, and sewage disposal. Many sources of water examined failed to meet Colorado Department of Health water-quality standards for raw drinkingwater use, for agricultural use, and for aquatic life. Chemical quality of the ground water, particularly water use, for agricultural use, and for aquatic life. Chemical quality of the ground water, particularly dissolved solids, is better in water from the unconsolidated—and crystalline-rock aquifers in the mountains and decreases in the aquifers on the plains. Factors involved in the decrease of quality are the geohydrology and the quality of associated surface water. Local contamination of ground water by subsurface wasterwater disposal is a frequent water to the contamination. quent problem. (USGS) W81-01031

WATER QUALITY OF BEAR CREEK BASIN, JACKSON COUNTY, OREGON, Geological Survey, Portland, OR. Water Resources Div. For primary bibliographic entry see Field 5A. W81-01032

WATER-QUALITY ASSESSMENT OF THE PORTER COUNTY WATERSHED, KANKAKEE RIVER BASIN, PORTER COUNTY, INDIANA, Geological Survey, Indianapolis, IN. Water Resources Div.

L. L. Bobo, and D. E. Renn.

L. L. Bodo, and D. E. Renn.
Available from the OFSS, USGS Box 25425, Fed.
Ctr., Denver, CO 80225, Price: \$7.50 in paper copy, \$4.50 in microfiche. Geological Survey Open-File Report 80-331, February, 1980. 54 p, 9 Fig, 11 Tab, 27 Ref.

Descriptors: *Water quality, *Surface waters, *Watersheds(Basins), *Municipal wastes, *Indiana, Streams, Water analysis, Chemical analysis, Water pollution sources, Dissolved solids, Dissolved oxygen, Sediments, Bacteria, Pesticides, Polychlorinated biphenyls, Coliforms, Phytoplankton, Evaluation, *Kankakee River basin, Porter County(IN).

Water type in the 241-square mile Porter County watershed in Indiana, was calcium bicarbonate or mixed calcium bicarbonate and calcium sulfate. Concentrations of dissolved chemical constituents in surface water and contents of chlorinated hy-drocarbons in streambed samples in the watershed were generally less than water-quality alert limits set by the U.S. Environmental Protection Agency, set by the U.S. Environmental Protection Agency, except in Crooked Creek. During sampling, this stream was affected by sewage, chlorinated hydrocarbons, and two chemical spills. Ranges of on-site field measurements were: specific conductance, from 102 to 1,060 micromhos per centimeter at 25 Celcius; water temperature, from 7.0 to 31.8 Celsius; pH, from 6.8 to 8.9; dissolved oxygen, from 2.5 to 14.9 milligrams per liter and from 27 to 148% saturation; and instantaneous discharge from 0 to 101 cubic feet per second. Concentrations of most dissolved-inorganic constituents (heavy metals and major ions) and dissolved solids did not vary significantly from one sampling period to the next at each site. Dissolved constituents whose concentrations varied significantly were iron, man-ganese, organic carbon, ammonia, nitrate plus ni-trite, organic nitrogen, Kjeldahl nitrogen, and phosphorus. Concentrations of dissolved manganese, organic carbon, dissolved nitrite plus nitrate, and suspended sediment varied seasonally at most and suspended sediment varied seasonary at most sites. Populations and identification of bacteria, phytoplankton, periphyton, and benthic inverte-brates indicate a well-balanced environment at most sites, except in Crooked Creek. (USGS) W81-01035

AN ECONOMIC ANALYSIS OF SELECTED STRATEGIES FOR DISSOLVED-OXYGEN MANAGEMENT: CHATTAHOOCHEE RIVER, GEORGIA,

Geological Survey, Reston, VA. Water Resources

Div. J. E. Schefter, and R. M. Hirsch. Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$3.00. Geological Survey Professional Paper 1140, 1980. 26 p, 16 Fig, 13 Tab, 5 Ref, Append.

Descriptors: *Cost analysis, *Dissolved oxygen, *Streams, *Water pollution sources, *Georgia, Water quality control, Planning, Powerplants, Inflow, Waste assimilative capacity, Model studies, Simulation analysis, Economic efficiency, Evaluation, *Chattathoochee River(GA), *Buford Dam(GA)

method for evaluating the cost-effectiveness A method for evaluating the cost-effectiveness of alternative strategies for dissolved-oxygen (DO) management is demonstrated, using the Chattahoo-chee River, GA., as an example. The conceptual framework for the analysis is suggested by the economic theory of production. The minimum flow of the river and the percentage of the total waste inflow receiving nitrification are considered to be two variable inputs to be used in the production of such minimum concentration of DO in the to be two variable lipius to be used in the produc-tion of given minimum concentration of DO in the river. Each of the inputs has a cost: the loss of dependable peak hydroelectric generating capacity at Buford Dam associated with flow augmentation and the cost associated with nitrification of wastes. The least-cost combination of minimum flow and waste treatment necessary to achieve a prescribed minimum DO concentration is identified. Results of the study indicate that, in some instances, the waste-assimilation capacity of the Chattahoochee River can be substituted for increased waste treatment; the associated savings in waste-treatment costs more than offset the benefits foregone because of the loss of peak generating capacity at costs more than offset the benefits foregone be-cause of the loss of peak generating capacity at Buford Dam. The sensitivity of the results to the estimates of the cost of replacing peak generating capacity is examined. It is also demonstrated that a flexible approach to the management of DO in the Chattahoochee River may be much more cost effective than a more rigid, institutional approach wherein constraints are placed on the flow of the river and(or) on waste-treatment practices. (USGS) W81-01036

GEOCHEMISTRY OF WATER IN THE FORT UNION FORMATION OF THE NORTHERN POWDER RIVER BASIN, SOUTHEASTERN

Geological Survey, Helena, MT. Water Resources

R. W. Lee. Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: \$8.00 in paper copy, \$4.50 in microfiche. Geological Survey Open-File Report 80-336 (WRI), June, 1980. 17 p, 7 Fig, 2 Plates, 2 Tab, 18 Ref.

Descriptors: *Geochemistry, *Groundwater, *Water quality, *River basins, *Montana, Hydro-geology, Streams, Water chemistry, Springs, Water wells, Bacteria, Cation exchange, *North Powder River basin(MT), Southeastern Montana.

Shallow water in the coal-bearing Fort Union For-Shallow water in the coal-bearing Fort Union For-mation of southeastern Montana was investigated to provide a better understanding of the geochem-istry. Springs, wells less than 200 feet deep, and wells greater then 200 feet deep were observed to have different water qualities. Overall, the ground water exists as two systems: a mosaic of shallow, chemically dynamic, and localized recharge-dis-charge cells superimposed on a deeper, chemically static regional system. Water chemistry is highly variable in the shallow system, whereas sodium and bicarbonate waters characterize the deeper system. Within the shallow system, springs, and wells less than 200 feet deep show predominantly sodium and sulfate enrichment processes from re-charge to discharge. These processes are consistent charge to discharge. These processes are consistent with the observed aquifer mineralogy and aqueous chemistry. However, intermittent mixing downward moving recharge waters or u

Sources Of Pollution-Group 5B

moving deeper waters, and bacterially catalyzed sulfate reduction, may cause apparent reversals these processes. (USGS)
W81-01041

INPUT INTO AND FATE OF LEAD IN A SMALL RESERVOIR.

SMALL RESERVOIR, Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst. A. W. McIntosh, J. V. Hunter, and P. Krug. Available from the National Technical Information

Avanaoir from the National Technical Information Service, Springfield, VA 22161 as P881-148074, Price codes: A03 in paper copy, A01 in microfiche. Final Technical Completion Report, October, 1980, 31 p., 3 Fig., 13 Tab, 27 Ref. OWRT-A-056-NJ(1), 14-34-0001-0132.

Descriptors: *Lead, Heavy metals, *Storm runoff, *Reservoirs, Inflow, *Land use, Environmental effects, Drainage area, Sediments, Cores, Sampling, Fish physiology, New Jersey, *Weston's Mill Pond(NJ).

Lead (Pb) concentrations in water samples collected from seven sites in Weston's Mill Pond, NJ., a water supply/recreation reservoir exposed to sub-stantial amounts of highway runoff, under varying meteorological conditions ranged from 18.3 to 34.9 ug/l. Highest average concentration over all sites (46.4 ug Pb/l) occurred after a period of heavy rainfall. The non-filterable fraction accounted for 80 to 96% of the total lead present in the water. The document of the lead present in the water. Lead concentrations in the upper 2 cm of sediment cores were as high as 439.7 ug/g (dry weight), and elevated levels existed throughout the cores (22.5 cm in depth) at some sites. Lead concentrations in the tissues of four species of fish collected from the reservoir consistently occurred in the following cortex cities. reservoir consistently occurred in the following order: gills > liver > muscle, with levels in the muscle less than 1 ug Pb/g (dry weight basis). Estimated loading of lead to the reservoir via a major tributary during a storm event was 3.22 pounds, with levels in the tributary reaching a maximum of 1.94 mg Pb/l during the storm. (McIntosh-Rutgers) W81-01045

BEHAVIOUR OF PHOSPHATE IN ESTUAR-

INE WATER, Melbourne Univ., Parkville, (Australia), Marine

Melbourne Univ., Farkvine, (Austrana), Marine Chemistry Lab.
J. D. Smith, and A. R. Longmore.
Nature, Vol 287, No 5782, p 532-534, October 9, 1980. 3 Fig. 1 Tab, 21 Ref.

Descriptors: *Phosphates, *Estuaries, *Iron compounds, *Water pollution, *Yarra River(Australia), Humic acids, Waste water(Pollution), Rivers, Sedimentology, Model studies, Phosphorus compounds, Inorganic compounds, Laboratory tests.

Since 1977 measurements of phosphate during high and low flow in the waters of the Yarra River estuary (Australia) showed wide variations, laboratory experiments were designed to study some of the non-biological factors in phosphate distribution. Results showed that the sequence and concentration of the additions of iron, humic acid, and phosphate to the river largely controlled the protection of phosphate account of the protection of phosphate account from solutions. portion of phosphate removed from solution in river water. Less than 10% inorganic removal of phosphate occurred in estuaries fed by rivers of average iron content. In the laboratory system, sea water was pumped into a vessel containing river water, and the mixture pumped out at the same water, and the mixture pumped out at the same rate. In the sample of river water used, 94.5% of the iron and 42% of the phosphate were associated with the particulate matter. Removal of iron was 70%; humic acid, 23%; and phosphate, 6%, with the salinity of maximum removal different for each component. A series of experiments using synthetic starting solutions showed that a maximum of 44% phosphate was removed in the presence of high phosphate was reinoved in the presence of ingal levels of iron and humic acid (starting solution, 9 mg humic acid, 750 mg iron, and 200 micrograms phosphate per liter). (Cassar-FRC) W81-01050

ALGAL AVAILABILITY OF SEDIMENT PHOS-PHORUS IN DRAINAGE WATER OF THE BLACK CREEK WATERSHED,

Purdue Univ., Lafayette, IN. Agricultural Experimental Station.
R. A. Dorich, D. W. Nelson, and L. E. Sommers

Journal of Environmental Quality, Vol 9, No 4, p 557-563, October/December, 1980. 1 Fig. 4 Tab,

Descriptors: *Agricultural watersheds, *Phosphorus, *Algae, Sediment-water interfaces, Laboratory tests, Sediment load, Indiana, Eutrophication.

The algal availability of phosphorus in suspended stream sediments of the Black Creek Watershed (Indiana) and the phosphorus fractions in suspend-ed stream sediments which are available to algae were evaluated. Sediments suspended in the agri-cultural watershed were separated, resuspended in a nutrient medium, inoculated with Selanastrum capricornutum, and incubated for two weeks under illumination. Before and after incubation, the media were analyzed for algal numbers and phosphorus assimilated by algal cells by sequential ex-traction with NH4F, NaOH, and HCl. Available sediment phosphorus in March and June samples averaged 20.7% of the total sediment phosphorus and 30.1% of the sediment inorganic phosphorus. Sediment phosphorus contributed significantly larger quantities of phosphorus than soluble phosphorus for algal growth during incubation. (Small-FRC) W81-01058

LITTERFALL, STEMFLOW, AND THROUGH-FALL NUTRIENT FLUXES IN AN ALLUVIAL SWAMP FOREST

East Carolina Univ., Greenville, NC. Dept. of Biology. M. M. Brinson, H. D. Bradshaw, R. N. Holmes,

and J. B. Elkins, Jr. Ecology, Vol 61, No 4, p 827-835, August, 1980. 2 Fig, 4 Tab, 51 Ref.

Descriptors: *Nutrients, *Swamps, *Forests, Stem-flow, Leaves, Humus, Cycling nutrients, Wetlands, Throughfall, Fluctuations, Canopy, Seasonal, Leaching, Weathering.

The nutrient cycling capacity of an alluvial forest of the Coastal Plain of North Carolina was compared with other wetland and upland ecosystems on which data was available. Sediments in the on which data was available. Sediments in the alluvial swamp forest are characterized by a higher concentration of exchangeable calcium and potassium and support more rapid growth of the water tupelo, Nyssa aquatica, than soils in non-alluvial headwater swamps. The annual litterfall of the study area was 6428 kilograms dry mass/hectare, 63% of this was N. aquatica leaves. Deposition of nutrients onto the forest floor in kilograms/hectare/year for litterfall and aqueous sources, respectively, were calculated to be 2779 and 91.5 for organic carbon, 5.38 and 1.55 for phosphorus, 17.0 and 7.60 for magnesium, 72.77 and 10.31 for nitrogen, 7.19 and 9.21 for sulfur, 45.1 and 15.31 for calcium, and 21.1 and 11.96 for potassium. Values m, and 21.1 and 11.96 for potassium. Values for these nutrients in mature upland temperate forests and still-water swamps have been reported to be lower. The high values for nitrogen and phosphorus in the alluvial forests were suspected phosphorus in the alluvial torrests were suspected of originating from fluvial sources, while atmos-pheric sinks and weathering formed the major nutrient inputs for upland forests and still-water swamps. (Geiger-FRC) W81-01065

DETRITAL PROCESSING AND ASSOCIATED MACROINVERTEBRATES IN A COLORADO

MOUNTAIN STREAM,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology. R. A. Short, S. P. Canton, and J. V. Ward.

Ecology, Vol 61, No 14, p 727-732, August, 1980. 5 Fig. 3 Tab, 18 Ref.

Descriptors: *Natural streams, *Leaves, *Invertebrates, Degradation, Organic matter, Organic loading, Colorado.

A study of leaf processing in a Colorado mountain stream was initiated to determine the processing rates of four common species of leaves, the nature

of the macroinvertebrates which colonize leaf litter, the importance of leaf litter as a source of, or collecting system for, fine particulate organic detri-tus, and finally, the importance of leaf litter as a habitat for fine particle-feeding detritivores. Processing occurred at rapid rates despite water temperatures at or near zero degrees centigrade. A high biomass of shredders was found per gram of leaf pack, which explains the rapid processing. Fine particulate organic matter may accumulate in leaf packs from two potential sources: leaf material in the pack as it is processed, and fine organic matter in transport which is trapped in the leaf pack. (Small-FRC) W81-01066

PHOTOLYSIS OF 3,4-DICHLOROANILINE IN NATURAL WATERS.

Nevada Univ., Reno. Div. of Biochemistry. For primary bibliographic entry see Field 5A.

VARIABILITY AND LOADING OF MERCURY IN A SMALL PRAIRIE RIVER, W. D. Gummer.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 530-536, October, 1980. 4 Fig. 14 Ref.

*Mercury, *Rivers, *Moose *Sediments, Descriptors: *Water pollution, *Moose Jaw River(Saskatchewan), Thunder Creek, Saskatchwan, Pollutants.

The magnitude and variability of mercury levels in The magnitude and variability of mercury levels in the Moose Jaw River, Saskatchewan, were investigated during a high flow period. Water samples of 500 ml were collected hourly for 35 days, April 18 to May 22, 1979. The maximum total mercury level, 0.13 micrograms per liter, in water samples occurred at peak flow and corresponded with susoccurred at peak now and corresponded with sus-pended sediment and particulate organic carbon maxima. Suspended sediment mercury levels were generally 0.15 micrograms per gram. However, on one occasion, erosion in the Thunder Creek tributary produced a suspended sediment mercury con-centration of 0.58 microliters per gram. Although particulate mercury was the predominant form, dissolved mercury increased slightly during peak dissorted interface and signify during peak flow, with maximum levels coinciding with a drop in suspended sediment and particulate organic carbon levels. (Cassar-FRC) W81-01110

MUSSELS (MYTILUS EDULIS) AS 'POINT SOURCE' INDICATORS OF TRACE METAL POLLUTION

Simon Fraser Univ., Burnaby (British Columbia). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W81-01115

COINCIDENCE OF CADMIUM AND ANTIBI-OTIC RESISTANCE IN NEW YORK BIGHT APEX BENTHIC MICROORGANISMS,

Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies. M. A. Devanas, C. D. Litchfield, C. McClean, and I. Gianni.

Marine Pollution Bulletin, Vol 11, No 9, p 264-269, 1980. 1 Fig, 2 Tab, 26 Ref.

Descriptors: *Chemicals, *Cadmium, *Benthic fauna, *Microorganisms, *Atlantic Ocean, Water pollution sources, Sludge disposal. Industrial wastes, Spoil banks, Dredging, Antibiotic resistance, Drug resistance, *New York Bight apex.

Microorganisms resistant to 1-500 ppm cadmium were isolated and tested for antibiotic resistances. Sediment samples were collected in the New York Sediment samples were confected in the New Total Bight apex in a sewage sludge disposal area, a dredge spoils area, an industrial acid wastes dump-ing area, and other sites. Sixty-nine cadmium resis-tant isolates were tested for antibiotic resistance with a spectrum of antibiotics: sulfachloropyridazine, penicillin, bacitracin, tetra-cycline compounds, streptomycin mixture, novo-biocin, neomycin, nalidixic acid, ampicillin, kana-

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B-Sources Of Pollution

mycin, and chloramphenicol. Ninety-four percent of the microorganisms exhibited antibiotic resistof the microorganisms exhibited antibiotic resistance to at least one of the compounds tested, while 91% displayed a multiple drug resistance pattern. The possibility of extrachromosomal linkage of cadmium and streptomycin resistance is discussed. (Small-FRC) W81-01116

VIRUSES IN GROUNDWATER, Baylor Coll. of Medicine, Houston, TX. B. H. Keswick, and C. P. Gerba. Environmental Sciences and Technology, Vol 14, No 11, p 1290-1297, November, 1980. 1 Fig. 6 Tab,

Descriptors: *Water quality, *Viruses, *Ground-water, Waste disposal, Land use, Public health, Diseases, Water pollution sources, Reviews.

A literature review is presented on viruses in groundwater in order to evaluate the present state of knowledge, assess current standards and monitoring practices, and recommend areas of research. Viruses have been isolated from groundwater Viruses have been isolated from groundwater sources and drinking water and from sites where land application or waste water experimentation is practiced. These viruses include Echo, Polio, Coxsackie, Rota, and B viruses. There are a growing number of studies of isolation of viruses in groundwater after land application of wastes, although there have been no disease outbreaks associated with these sites. More studies are needed on the receival of viruses in groundwater and their ability. survival of viruses in groundwater and their ability to migrate long distances. Also, monitoring virus concentration in land application areas after rainfall and under various geological conditions is proposed. (Small-FRC) W31-01121

MASS BALANCE. Anglian Water Authority, Huntingdon (England).
Directorate of Resource Planning. A. E. Warn, and J. S. Brew. Water Research, Vol 14, No 10, p 1427-1434, October, 1980. 2 Fig, 4 Tab, 13 Ref.

Descriptors: Discharge, *Discharge measurement, *Flow, Monte Carlo method, *Effluents, *Hydrologic equation. Simulation analysis, *Model studies, Channel flow, Hydraulics, Water pollution, Mathematical studies, Statistical models, Computer models, Numerical analysis, Surface waters, Computers, Water quality control.

Two methods for calculating mean and percentile values of river quality downstream of a discharge are compared. Both relate percentile values of downstream water quality to percentile values of discharge quality, producing more accurate results than with a simple mass balance. The analytical method can be used on a programmable calculator, while the Monte Carlo method is versatile because it can cope with data that are not log-normal and with correlation between the variables. It is par-ticularly useful in problems of pollution control by river flow augmentation. It gives approximate values for the mean and standard deviation of T values for the mean and standard deviation of T even where the distributions assumed for its data are accurate. The analytical method gives accurate values of the mean and standard deviation of T provided the assumption of log-normal flows is accurate. Some advantage is obtained by using both methods to check the sensitivity of the results. (Titus-FRC)

AN AUTOMATED SYSTEM FOR MONITOR-ING THE KINETICS OF BIOLOGICAL OXIDA-TION OF AMMONIA, Consiglio Nazionale delle Ricerche, Rome (Italy).

Inst. for Water Research.

R. Ramadori, A. Rozzi, and V. Tandoi

Water Research, Vol 14, No 10, p 1555-1557, October, 1980. 2 Fig. 2 Tab, 2 Ref.

Descriptors: *Ammonia, *Chemical reactions, *Sludge treatment, Cultures, Testing procedures, *Nitrification, Time series analysis, Denitrification, Waste treatment, *Oxidation, Microorganisms, Equipment, Volumetric analysis, Spectrophoto-

A technique is proposed for accurate determina-tion of nitrifiying kinetics in cultures of Nitroso-monas bacteria. The temperature, dissolved oxygen content, ammonium concentration, pH and volume of the sample are established and the rate of nitrification is determined by monitoring the alkali consumption of the sample on a continuous data recorder. Concentrations of volatile suspended solids and ammonia, nitrite, and nitrate nitrogen are determined at the end of the test. The mass of oxidized ammonia is determined by spectrophotometry, by sodium hydroxide consumption, and by a nitrogen mass balance at the beginning and end of the test. The technique produces results in good agreement with conventional methods. It minimizes interpolation errors and avoids interference from other microorganisms. (Titus-FRC) W81-01135

A REACTION CHAMBER FOR STUDY OF IN-TERACTIONS BETWEEN SEDIMENTS AND WATER UNDER CONDITIONS OF STATIC OR

WATER UNDER CONDITIONS OF STATIC OR CONTINUOUS FLOW, Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. D. Gunnison, J. M. Brannon, I. Smith, Jr., G. A. Burton, and K. M. Preston. Water Research, Vol 14, No 10, p 1529-1532, October, 1980. 2 Fig. 2 Tab, 9 Ref.

Descriptors: *Sediment-water interfaces, *Lake sediments, *Reservoirs, *Organic loading, *Methodology, Continuous flow, Flooding, Flow, Sediments, Reservoir silting, Sediment distribution, Reservoir operation, Standing waters, Sediment transport, Reservoir construction.

A soil/sediment-water reaction chamber has been designed for use in studies to assess the impact of soil flooding upon the chemical composition of overlying waters. The chamber consists of a plexiglass column fitted with an air-trapping system and with provisions for continuous and variable flow of water, a circulation pump, and sampling ports. The variable flow rate allows a retention period of 17.4 to 347 days for water in the chamber. The chamber has been used in studies of the aging of flooded soil and of effects of organic loading on reservoir water quality. It has potential application to problems of reservoir creation and application to proteins of reservoir estation and restoration and for developing rate coefficients for mathematical water quality models. Major advantages of this system are the large volume which minimizes the impact of removal of a large volume of sample, the large sediment-water contact area, and the ability to use the system in either a static or flow-through mode. (Titus-FRC)

THE EFFECT OF CONCENTRATION OF ADSORBING SOLIDS ON THE PARTITION CO-

Manhattan Coll., Bronx, NY. Dept. of Civil Engi-

D. J. O'Connor, and J. P. Connolly. Water Research, Vol 14, No 10, p 1517-1523, October, 1980. 7 Fig, 1 Tab, 21 Ref.

Descriptors: *Mathematical studies, *Laboratory tests, *Equilibrium, Hydrologic equations, *Adsorption, *Solids contact processes, Sediments, Soils, Sludge digestion, Heavy metals, Organic compounds, Reaction rates, Pesticide kinetics, Sorption, Soil properties.

Laboratory studies demonstrate an inverse relationship between the concentration of adsorbing solids and the partition coefficient in natural water systems. The partition coefficient is defined as the ratio between the solid-phase and dissolved concentrations, and it is a function of the solubility of the adsorbate and of the organic and clay fractions of the adsorbent. Different compounds adsorbing to the same solids have similar concentration dependences. For example, DDT, heptachlor and dieldrin adsorb to kaolinite, illite and montmorilonite, and cobalt and ruthenium adsorb to Lake Austin sediment at comparable slopes or concentration dependences. This is also true for Dimilin and Kepone adsorbing to Range Point sediment and for heavy metals adsorbing to digested sludge. These relationships have numerous implications to the distribution and retention of heavy metals and organic chemicals in natural water systems. (Titus-W81-01144

KINETICS OF TRACE METAL PARTITION-ING IN MODEL ANOXIC MARINE SEDI-MENTS, Oregon State Univ., Corvallis. Dept. of Civil Engi-

neering. S. M. Oakley, C. E. Delphey, K. J. Williamson, and P. O. Nelson. Water Research, Vol 14, No 8, p 1067-1072, 1980. 6 Fig. 2 Tab, 12 Ref. OWRT A-051-ORE(1).

Descriptors: *Trace elements, *Metals, *Sediments, *Laboratory tests, *Kinetics, Heavy metals, Pollutants, Path of pollutants, Copper, Cadmium, Lead, Zinc, Chemical analysis, Sulfides, Water pollution, Water quality, Marine sediments.

A model anaerobic sediment consisting of humic acid, clay, ferrous sulfide, sand, and seawater was utilized to study the partitioning of Cu, Cd, Pb, and Zn between different geochemical phases. An extraction scheme was developed that was selective for each geochemical phase. Metals were dosed on one phase separately, and then mixed into the other undosed phrases. The kinetics of partitioning were rapid, regardless of which phase was initially dosed; equilibrium was reached within 2-5 days. The stoichiometry of distribution was also independent of the initially dosed phase. The final metal distributions showed that the metal sulfide phase was not necessarily the dominant trace metal phase was not necessarily the dominant trace metal sink in anaerobic sediments. (Sims-ISWS) W81-01154

INTERACTIONS AND SURVIVAL OF ENTER-IC VIRUSES IN SOIL MATERIALS,

North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

M. D. Sobsey, C. H. Dean, M. E. Knuckles, and R.

A. Wagnet. Applied and Environmental Microbiology, Vol 40, No 1, p 92-101, July, 1980. 10 Tab, 24 Ref. OWRT-A-090-NC(5), 14-34-0001-6034, 14-34-

Descriptors: *Viruses, *Soils, Earth, Clay loam, Enteric viruses, *Waste water treatment, *Adsorp-tion, Soil materials, Viruses removal, *Soil types, Domestic wastes, Animal wastes(Wildlife), Land-

fills, Irrigation water.

There were marked differences in the abilities of eight different soil materials to remove and retain eight different soil materials to remove and retain viruses from settled sewage, but for each soil material the behavior of two different viruses, poliovirus type 1 and reovirus type 3, was often similar. Virus adsorption to soil materials was rapid, the majority occurring within 15 min. Clayey materials efficiently adsorbed both viruses from waste water over a range of pH and total dissolved solids levels. Sands and organic soil materials were comparatively poor adsorbents, but in some cases their adjustic progression of the progression o ability to adsorb viruses increased at low pH and with the addition of total dissolved solids or diva-lent cations. Viruses in suspensions of soil material in settled sewage survived for considerable time in settled sewage survived for considerable time periods, despite microbial activity. In some cases virus survival was prolonged in suspensions of soil materials compared to soil-free controls. Although sandy and organic soil materials were poor virus adsorbents when suspended in waste water, they gave > or = 95% virus removal from intermitently applied waste water as unsaturated, 10-cm-deep columns. However, considerable quantities of the estimated interest was unsaturated. the retained viruses were washed from the col-umns by simulated rainfall. Under the same condisystimated raman crocker the same controls, tions, clayey soil material removed > or = 99.995% of the viruses from applied waste water, and none were washed from the columns by simulated rainfall.

Effects Of Pollution-Group 5C

TRANSLOCATION OF MERCURY AND MICROBIAL ADAPTATION IN A MODEL AQUATIC SYSTEM, Ohio State Univ., Columbus. Dept. of Microbiolo-

J. A. Titus, J. E. Parsons, and R. M. Pfister. Bulletin of Environmental Contamination and Toxicology, Vol 25, No 3, p 456-464, September, 1980. 7 Fig, 34 Ref. OWRT-A-042-OHIO(2).

Descriptors: *Mercury, *Bacteria, *Sediments, *Adaptation, Model studies, Metals, Water pollution sources, Water pollution effects, Gastropods, Aquatic life, Fish, Toxins, Resistance, Lakes, Microbiology, Bottom sediments, Laboratory tests, Path of pollutants.

The movement of mercury through components of a 20-gal aquarium model aquatic system and changes in mercury-resistant levels of bacterial changes in mercury-resistant levels of bacterial populations with increasing sediment mercury load were investigated. Metallic mercury (1 g HgO) was introduced into the mud layer of bed sediments in the model system via a glass tube. In the study of bacterial populations, 0.5 mg Hg(2+)/ liter was added daily for 9 wk to the model system, after which it was increased to 5.0 mg Hg(2+)/ liter. In less than 7 wk, mercury was found in all test sites of the acurein. test sites of the aquarium. Mercury moved through the sediment with an increasing rate. Levels of mercury in tank water were undetected until the sediment had been traversed. Mercury was accumulated 1,000-fold over levels in tank water in two gastropods. Fish also bioaccumulated mercury. It gastropods. Fish also bioaccumulated mercury, it was thought that the bacterial populations may have been altered in their sensitivity to mercury due to the rapid passage of mercury throughout the bottom sediments. After 5 wk, the mercury content of the sediment reached 0.25 microgram Hg/g. Little change occurred in the total viable rig/g. Little change occurred in the total viable count (TVC) at the beginning of the experiment, but a large increase was found in the percentage of the TVC that was resistant to 6 micrograms Hg(2+)/ml at 3 wk. At wk. 9, when mercury flow rate was increased to 10 mg Hg(2+)/day, mercury content of sediments rose, while TVC values declined slightly, and percentage of TVC values de-clined slightly, and percentage of TVC resistant to 6 micrograms Hg(2+)/milliliter rose from about 1% to 10% (falling to 5% after 16 wk). (Geiger-FRC) W81-01174

WATER-QUALITY MONITORING OF THREE MAJOR TRIBUTARIES TO THE CHESA-PEAKE BAY--INTERIM DATA REPORT, Geological Survey, Towson, MD. Water Resources Div. For primary bibliographic entry see Field 7C. W81-01184

SUSCEPTIBILITY OF THE MEMPHIS WATER SUPPLY TO CONTAMINATION FROM THE PESTICIDE WASTE DISPOSAL SITE IN NORTHEASTERN HARDEMAN COUNTY, TENNESSEE.

Geological Survey, Nashville, TN. Water Resources Div.

Solution 27.

D. R. Rima.

Geological Survey Open-File Report 79-750, 1979.

5 p, 1 Fig, 3 Ref.

Descriptors: *Water pollution, *Pesticides, *Waste dumps, *Water supply, *Tennessee, Waste disposal, Leachate, Groundwater movement, Path of pollutants, Water pollution sources, *Hardeman lutants, Water pollution sources, County(TN), Memphis(TN).

Public concern has been expressed over the possibhity that leachates from a pesticide waste-disposal site in northeastern Hardeman County, Tennessee, might eventually reach the Memphis area and endanger the city's water supply. An examination of the possible pathways and means of transport of these contaminants reveals that, the Memphis area in detectable concentrations is unlikely. (USGS) W81-01192

AVAILABILITY AND QUALITY OF GROUND-WATER, SOUTHERN UTE INDIAN RESERVA-TION, SOUTHWESTERN COLORADO,

Geological Survey, Lakewood, CO. Water Resources Div . E. Brogden, E. C. Hutchinson, and D. E.

Hillier.

Hillier. Available from Supt. of Documents, GPO, Washington, DC 20402, Price, \$1.75. Geological Survey Water-Supply Paper 1576-J, 1979. 28 p, 4 Fig, 1 Plate, 5 Tab, 11 Ref.

Descriptors: *Groundwater availability, *Water quality, *Water chemistry, *Aquifer characteristics, *Colorado, Hydrogeology, Water wells, Water supply, Water yield, Potable water, Water quality standards, *Southern Ute Indian quality standar Reservation(CO).

Population growth and the potential development of subsurface mineral resources have increased the need for good quality groundwater on the South-ern Ute Indian Reservation in southwestern Colo-rado. A study was conducted during 1974-76 to assess the groundwater resources of the reservaassess the groundwater resources of the reserva-tion. Water occurs in aquifers in the Dakota Sand-stone, Mancos Shale, Mesaverde Group, Lewis Shale, Pictured Cliffs Sandstone, Fruitland Formation, Kirtland Shale, Animas and San Jose Formation, Kırlland Shale, Animas and San Jose Forma-tions, and terrace and flood-plain deposits. Well yields from sandstone and shale aquifers are small, generally in the range from 1 to 10 gal/min (gal-lons per minute), with maximum reported yields of 75 gal/min. Well yields from terrace deposits gen-really range from 5 to 10 gal/min with maximum 75 gal/min. Well yields from terrace teposite garaly range from 5 to 10 gal/min with maximum yields of 50 gal/min. Well yields from flood-plain deposits are as much as 25 gal/min. Water quality deposits are as much as 25 gal/min. Water quality deposits are as much as 25 gal/min. Water quality in aquifers depends in part on rock type. Water from sandstone, terrace, and flood-plain aquifers is predominantly a calcium bicarbonate type, whereas water from shale aquifers is predominantly a sodium bicarbonate type. Water from rocks containing interbeds of coal or carbonaceous shales may be either a calcium or sodium sulfate type. Dissolved-solids concentrations of groundwater range from 115 to 7,130 mg/L. Water from bedrock aquifers is the most highly mineralized, while water from terrace and flood-plain aquifers is the least mineralized. In many water samples collected water from terrace and flood-plain aquifers is the least mineralized. In many water samples collected from bedrock, terrace, and flood-plain aquifers, the concentrations of arsenic, chloride, dissolved solids, fluoride, iron, manganese, nitrate, selenium, and sulfate exceeded U.S. Public Health Service (1962) recommended limits for drinking water. Selenium in the ground water in excess of the recommended limit of 10 micrograms per liter for drinking water occurs throughout the reservation but principally in the central part. (USGS) W81-01197

5C. Effects Of Pollution

THE ROLE OF CORTISOL IN STRESS-IN-DUCED METABOLIC CHANGES IN FUNDU-LUS HETEROCLITUS,

Delaware Univ., Newark. School of Life and Health Sciences.

G. J. Leach, and M. H. Taylor. General and Comparative Endocrinology, Vol 42, p 219-227, 1980. 2 Fig, 2 Tab, 39 Ref. OWRT-A-

Descriptors: *Stress analysis, *Metabolism, *Teleosts, *Fish, *Environmental effects, Fish passages, Fish migration, Analysis, Analytical techniques, Strain, Animal metabolism, Proteins, Biochemistry, Aquatic life, Aquatic animals, Fish diseases, Fish behavior, Analyical techniques, Research and development, Testing, Evaluation, Measurement

Adult Fundulus heteroclitus fish were obtained from salt marsh tidal creeks on the lower Delaware Bay and acclimated to laboratory conditions prior to experimentation. Studies were conducted to determine if the metabolic changes reported earlier for cortisol treatment also occurred in response to endogenous cortisol elevations. Cortisol and relevant metabolic parameters were measured in fish exposed to restraint stress. Metyrapone (MP) treatment was used to isolate metabolic responses specifically attributable to the cortisol elevation. The test fish responded to a number of nonspecific stress stimuli, with transient elevations

in serum cortisol levels. MP treatment suppressed stress-stimulated peaks, but did not alter resting cortisol levels. MP also elevated serum '11-deoxycortisol levels. MP also elevated serum '11-deoxy-cortisol' levels. Fasted fish exposed to restraint stress in a 30 hour stress experiment exhibited marked hyperglycemia, while MP-treated fish ex-posed to the same stress showed initial hyperglyce-mia but not the sustained peak seen in untreated fish. Liver glycogen in stressed fish was somewhat higher than in MP-treated stressed fish for muscle glycogen, serum protein, or amino acid content of serum, liver, or muscle. It was concluded that during stress in this species, cortisol appears to act to sustain the elevation in serum glucose. (Zietus) linski-IPA) W81-01007

INFLUENCE OF COAL HUMIC ACID ON THE GROWTH OF CHLORELLA ALGAE.

ALGAE, Missouri Univ.-Columbia. Dept. of Chemistry. S. L. Hoeffner, and S. E. Manahan. Journal of Environmental Science and Health, Vol A15, No 2, p 149-161, 1980. 2 Fig, 2 Tab, 11 Ref. OWRT-B-145-MO(1).

Descriptors: "Algae, "Chlorella, "Humic acids, "Coals, Water pollution, "Mine acids, "Water pollution effects, Waste water(Pollution), Slurries, Coal mines, Hydraulic mining, Effects, Eutrophication, Research and development, Testing, Assay, Chelation, Chemical reactions, Pollutants, Pollutant ant identification, Measurement, Evaluation, Estimating.

The effects of coal humic acid leached from coal under coal slurry pipeline conditions and related circumstances on the growth of algae and on potential eutrophication of waters exposed to coal humic substances were studied. Coal humic acid humic substances were studied. Coal humic acid was prepared by partial oxidation of Wyoming subbituminous coal with hydrogen peroxide in a basic medium. Algae (Chlorella vulgaris) were grown in media containing 1.2 mg/liter EDTA, or 75 mg/liter coal humic acid, or in media in which the amount of chelating agent (EDTA) or coal humic acid were varied. At lower levels humic acid was found to stimulate algae growth. Optimum growth was obtained at 75 mg/liter of coal humic acid for algae acclimated to coal humic acid and 55 mg/liter for non-acclimated algae. Low and 55 mg/liter for non-acclimated algae. Low concentrations of EDTA gave erratic results. Growth of algae at very low concentrations of coal humic acid was similar to that seen in the absence of added chelating agent, with the latter cultures often growing faster in later stages of cultures often growing taster in later stages of growth. It was suggested that algae excrete a chelating substance that only functions in the absence of added chelating agent. The study indicated that coal humic acid affects algae growth similar to humic acids from more natural sources. (Zielinski-IBA) W81-01009

CHANGES IN NUTRIENT ION LEVEL OF SUBSTRATES AND STREAM WATER DUE TO LAND MANAGEMENT IN NORTHUMBER-LAND

Northumberland Coll. of Education, Newcastle-upon-Tyne (England). Dept. of Environmental

J. E. Hobrough, and S. Frost. Environmental Pollution (Series A), Vol 23, No 2, p 81-93, October, 1980. 4 Fig, 4 Tab, 25 Ref.

Descriptors: *Nutrients, *Agricultural watersheds, *Water analysis, Nitrites, Nitrates, Phosphorus, Feed lots, Fertilizers, Water quality, Water pollution sources, Sediments, United Kingdom.

Changes in water chemistry due to watershed land use in Northumberland were attributed to the use use in Northumberiand were attributed to the use of Rumevite feeding licks in sheep pens. The resulting animal droppings and spillage from the licks and feed bags made their way into the streams. Water samples and sediment samples from the streams and the River pont were analyzed for the streams and the River pont were analyzed for ammonia, nitrite, nitrate, phosphate, potassium, sodium, calcium, and pH. The streams also received drainage from agricultural lands and

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C-Effects Of Pollution

sewage and urban runoff. Comparisons of the chemical composition of substrates and flowing water revealed significant differences in concentra-tion between water and the stream bed. Further biological evaluation is suggested to determine the effects of the pollution on the flora and fauna of the systems. (Small-FRC) W81-01046

ALGAL AVAILABILITY OF SEDIMENT PHOS-PHORUS IN DRAINAGE WATER OF THE BLACK CREEK WATERSHED, Purdue Univ., Lafayette, IN. Agricultural Experi-

For primary bibliographic entry see Field 5B. W81-01058 mental Station

LONG TERM EFFECT OF SEWAGE SLUDGE ADDITIONS ON POPULATIONS OF NOCAR-DIA ASTEROIDES, MICROMONOSPORA AND THERMOACTINOMYCES IN SOIL, Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.

V. A. Orchard. Soil Biology and Biochemistry, Vol 12, No 5, p 477-481, 1980. 5 Fig, 21 Ref.

Descriptors: *Sewage sludge, *Environmental effects, *Populations, *Soil fungi, Sludge disposal, Soil microorganisms, Actinomycetes, Landfills, Plant growth, Nutrients, On-site tests, Pathogenic

The effects of applications of both wet and dried sludge to soil populations of Nocardia asteroides, Micromonospora spp, and Thermoactinomyces spp were examined in plot experiments. The amount of herbage harvested from the plots over the three year test period was also determined to evaluate the relationship between increased dry matter and sludge decomposition. A sustained zymogenous-like response was observed in Micromonospora when the complex recalcitrant organic substrates that occur in dried sludge were applied to the soil. Wet sludge, which contains less organic material, had no effect on populations of Nocardia and Micromonospora when added to the soil. Contrastingly, greater numbers of Thermoactinomyses were isolated from wet, rather than dry sludge plots. Evaluations of herbage produced during the three year study indicated that plant nutrients were continually mineralized after addition of sewage sludge. (Geiger-FRC) W81-01061

LAND USE. PIGS IN POKES: PORK BARREL WATER PROJECTS, League of Women Voters, Rochester, NY.

J. Wellers, and O. Berg. Environment, Vol 22, No 8, p 5, 42-43, October, 1980. 3 Ref

Descriptors: *Lakes, *Recreation facilities, *Land use, Legislation, Water pollution, Water resources, Non-consumptive use, Recreation demand, Lake Ontario, Esthetics, New York, Future planning, Canal construction, Environmental effects.

An overview is given of the situation existing between the Army Corps of Engineers and the inland lake, Irondequoit Bay, which is separated from Lake Ontario by a thin natural sand bar. This recreational lake in New York state has long been under consideration as a site for harboring and launching yachts and other craft. The Corps has proposed a project which would build a canal to connect the smaller lake to Lake Operate. connect the smaller lake to Lake Ontario by cutting through the sand bar and also construct a ting through the sand bar and also construct a bridge over the waterway. Such alterations may endanger the fragile glacial sand slopes that provide aesthetic value to the lake which, at the present, supports only facilities for small boats. Added pollution of lake water from use by larger vessels is also feared, although supporters of the proposed project argue that a mixing of the already polluted lake waters with those of the Great Laker may halp to ease the existing sullviting sides. Lakes may help to ease the existing pollution situa-tion. Twenty years of formal discussion on the project have taken place, but special interest groups have always managed to block initiation of the work on the grounds of how the sand bar is to be opened rather than whether or not to open it. be opened rather than whether or not to open it.
Although cost-benefit analyses apparently indicate
a profit to local government if the project is executed, local residents still wish to block the construction of the artificial waterway to protect their
homes and property. Pure water projects have
alleviated problems of high salt deposits in the lake from local pollution. Criticisms of federal actions in such cases as that described for Irondequoit Bay (which is still unsettled) are based on the government's seeming indifference to the consequences of the project on the environment. (Geiger-FRC) W31-01063

DETRITAL PROCESSING AND ASSOCIATED MACROINVERTEBRATES IN A COLORADO

MOUNTAIN STREAM,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology. For primary bibliographic entry see Field 5B. w81-01066

SOME PROBLEMS OF AQUATIC ENVIRON-MENTS IN EGYPT FROM A GENERAL VIEW-POINT OF NILE ECOLOGY,

Biological Association, Ambleside, Freshwater (England). J. F. Talling.

Water Supply and Management, Vol 4, No 1-2, p 13-20, 1980, 59 Ref.

Descriptors: *Nile River, *Reviews, *Aquatic environments, Phytoplankton, River systems, Water pollution, Salinity, Systematics, Lakes, Limnology, Nutrients, Water pollution sources, Path of pollutants, Conductivity, Fluctuations, Egypt.

Some ecological problems of the Nile River are reviewed with a focus on their origin at points upstream. Population sequences obtained by longitudinal surveys in upstream basins could greatly enhance the knowledge of temporal sequences observed downstream. Some examples of combined longitudinal and seasonal surveys from Sudan and Egypt are mentioned. The effects of over-year water storage in Lake Nasser-Nubia upon the periodicity of nutrients, phytopolankton growth and odicity of nutrients, phytoplankton growth and sediment patterns downstream are also considered. More basic limnological studies of Lake Nasser-Nubia are needed to learn more about its nutrients, diurnal changes, populations, and biological and chemical properties. The problems of salinity, nutrient enrichment and pollution effects are ad-dressed in relation to their possible origins from areas upstream. More studies are also needed on changes in chemical and physical properties of the river water. Accurate taxonomic identifications are also vital to studies along the Nile, and some examples of the occurrence of species of the diatom Melosira are included. (Geiger-FRC) W81-01072

RELATIONSHIP OF POLLUTION TO ROCKY SUBSTRATUM POLYCHAETES ON THE FRENCH MEDITERRANEAN COAST, Centre d'Oceanographie, Marseille (France). Sta-tion Marine d'Endoume.

For primary bibliographic entry see Field 5A. W81-01099

EFFECTS OF HEAVY METALS IN COMBINA-TION WITH NTA, HUMIC ACID, AND SUS-PENDED SEDIMENT ON NATURAL PHYTO-PLANKTON PHOTOSYNTHESIS,

Oslo Univ. (Norway). D. Hongve, O. K. Skogheim, A. Hindar, and H. Abrahamsen

Apranamsen.

Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 594-600, October, 1980. 1 Fig., 1 Tab, 20 Ref.

Descriptors: *Water pollution effects, *Metals, Phytoplankton, *Heavy metals, Nitrilotriacetic acid, Pollutants, Water pollution, Lead, Mercury, Cadmium, Copper, Zinc, Aquatic life, Phytotoxicity, Photosynthesis.

The acute effects of copper, cadmium, lead, zinc, and mercury on a natural phytoplankton communi-

ty were evaluated separately and in combination in Lake Tyrifjorden under different experimental circumstances. The addition of suspended sediment alone to lake water increased photosynthesis about 19%. The four experimental series conducted in-cluded natural water + metals; natural water + metals + sediment; natural water + metals + humus; and natural water + metals + NTA (nitrinumus; and natural water + metais + N1A (nutri-lotriacetic acid). The first experiment indicated that the order of metal toxicity toward natural phytoplankton was: Hg, Cu, Cd, Pb, and Zn, in decreasing order. The effect of heavy metals in water enriched with natural sediment was to reduce the photosynthesis, but the reduction was less than in control water without sediment. The metals, both individually and in combination, in-hibited photosynthesis of phytoplankton. The tox-icity arising from metal mixtures was an obvious result of synergism. A moderate increase in turbi-dity of the water reduced biological availability of the metals, thus reducing their inhibitory effect on the rate of photosynthesis. NTA led to detoxifica-tion of all tested concentrations of Cu and Cd. 2n and Pb were also detoxified at concentrations less than 10 sup-5M. The metal-NTA complex was more toxic than ionic forms of the metal in the case of mercury. It is noted that the addition of NTA to of mercury. It is noted that the addition of NTA to Lake Tyrifjorden will give directly, without microbiological methylation, a substance which may affect the plankton photosynthesis at a concentration which is only slightly higher than the present concentration of mercury in the lake. (Baker-FRC) W81-01108

SEASONAL AND SPECIES-DEPENDENT VARIABILITY IN THE BIOLOGICAL IMPACT VARIABILITY IN THE BIOLOGICAL IMPACT OF MINE WASTES IN AN ALPINE RIVER, Alberta Environmental Center, Vegreville. J. W. Moore.
Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 524-529, October, 1980. 1 Fig. 1 Tab, 10 Ref.

Descriptors: *Mine wastes, *Algae, *Aquatic life, *Environmental effects, Flat River(Alberta), Water pollution effects, Pollutants, Copper, Cya-nide, Invertebrates, Tungsten mine, Insects, Mining, Northwest territories, Alberta.

The effects of mine wastes on aquatic communities varied significantly with species and season. Samples of invertebrates, algae, sediments, and water were collected near a tungsten mine in the Flat River, Canadian Northwest Territory, upstream and at nine stations 0 to 30 kilometers downstream from this area. Analysis of river water showed that concentrations of copper, manganese, beryllium, iron, cobalt, and cyanide increased sharply near the mine compared with control areas. Concentrations of arsenic, lead, zinc, cadmium, and mercury were low throughout the river. Total hardness and pH showed little variation at stations sampled. Heavy metals were generally below detectable limits. Total phosphorus and nitrate concentrations increased at certain stations due to sewage input. The 107 species of algae detected and counted varied inconsistently with location in the river, but were greater near the mine in December. Of 29 species of benthic invertebrates studied, the predominant chironomids were restricted to stations below the mine. Mayflies decreased near the mine. Other species did not show a consistent pattern among the stations. Species composition during December differed considerably from summer populations, invertebrate species densities being higher in December, probably because cold temperatures reduced the toxicity of copper and cyanide. (Cassar-FRC) W81-01111

COINCIDENCE OF CADMIUM AND ANTIBI-OTIC RESISTANCE IN NEW YORK BIGHT APEX BENTHIC MICROORGANISMS, Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies For primary bibliographic entry see Field 5B. W81-01116

REHABILITATION OF THE INNER THAMES

Effects Of Pollution—Group 5C

Thames Water Authority, London (England). M. J. Andrews, and D. G. Rickard. Marine Pollution Bulletin, Vol 11, No 11, p 327-331, November, 1980. 6 Fig, 17 Ref.

Descriptors: *Reclamation, *Estuaries, *Fish, Shrimp, Fecundity, Density, Habitat improvement, Ducks, *Thames River, United Kingdom.

The recolonization of the inner Thames estuary The recolonization of the inner Thames estuary during 1976-80 was characterized by increases in population size, animal fecundity, and species diversity. The number of species recorded in the inner estuary increased almost linearly with time until 1976, when all fresh water and euryhaline fish species indigenous to the Thames system had been collected as well as 95% of the marine species prevalent in the southern North Sea. The changing status of many fish species has caused alterations in population structure. Macroinvertebrate studies since 1974 have shown a shift from an assemblaze since 1974 have shown a shift from an assemblage dominated by tubificid worms to a more stable multi-specied community. Organisms recently found included oligochaete worms, polychaete worms, amphipods, isopods, molluses and crustaceans. Thousands of gravid shrimp and gravid prawn have been observed in the inner Thames. In 1967-70, only one berried shrimp was found among more than 40,000 examined. Algal and waterfowl populations have also recovered to some extent. The influx of organisms beginning in 1964 was related to improved water quality and the return to aerobicity in the summer months following the rebuilding of the Crossness sewage treatment works. The second phase followed the commis-sioning of extensions to London's other main sewage treatment works at Beckton. (Small-FRC) W81-01118

CHANGES IN THE ZOOPLANKTON OF ON-ONDAGA LAKE (NY), 1969-1978, Syracuse Univ., NY. Dept. of Civil Engineering. M. A. Meyer, and S. W. Effler. Environmental Pollution (Series A), Vol 23, No 2, p 131-152, October, 1980. 4 Fig, 10 Tab, 73 Ref.

Descriptors: *Zooplankton, *Lakes, *Eutrophica-tion, *Reclamation, Phytoplankton, Lake stages, Primary productivity, Water pollution effects, New York, Onondaga Lake, Fish, Reviews.

A comprehensive zooplankton study of polluted hypereutrophic Onondaga Lake in New York State was conducted in 1978. Changes in the zoo-plankton community since an original investigation in 1969 were determined. Re-establishment of the in 1909 were determined. Re-establishment of the alewife, a size-selective planktivore, probably caused the reduction in large daphnids, in spite of the overall increase in zooplankton biomass and concentration since 1969. The alewife probably had a significant influence, based on the small sizes of dominant microcrustaceans and their probable high turnover rates in such a eutrophic system. The most dramatic change in the lake, the ten- to twenty-fold increase in biomass, may be the result of reclamation efforts which have caused changes in the phytoplankton population. Zooplankton-phytoplankton interactions may delay or resist fur-ther reclamation efforts aimed at primary productivity. (Small-FRC) W81-01122

GAS CHROMATOGRAPHY COMBINED WITH MASS SPECTROMETRY FOR THE IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS IN SHELLFISH AND FISH, Okayama Univ. (Japan). Dept. of Public Hygiene. M. Ogata, and Y. Miyake. Journal of Chromatographic Science, Vol 18, No 11, p 594-605, November, 1980. 12 Fig, 4 Tab, 11 Ref.

Descriptors: *Oil, *Clams, *Mass spectrometry, *Gas chromatography, Laboratory tests, Fish, Analytical techniques, Sulfur compounds, Water pollution effects, Crude oil.

Organic sulfur compounds contained in crude oils can be used as markers of oil pollution in shellfish and fish. Eels and short-necked clams were maintained in the laboratory in water containing crude oil. Mass spectra and mass chromatograms of short-necked clam extract indicated the presence of organic sulfur compounds of alkyl- (C1 to C10) benzothiophenes, dibenzothiophene, alkyl- (C1 to C8) dibenzothiophene, naphthalene, and alkyl- (C1 to C6) naphthalene. Capillary column gas chromatograms of crude oil and to Co) naprimatene. Capitary column gas chroma-tography-mass chromatograms of crude oil and short-necked clam extract indicated the presence of alkyl benzothiophene (C2-C6), dibenzothio-phene, and alkyl dibenzothiophene (C1-Cr). A new intensity matching method was devised for the identification of sulfur compounds by capillary gas chromatography/mass spectrometry. (Small-FRC) W81-01123

PREDATOR-PREY RELATIONS IMPORTANT FOR THE BIOTIC CHANGES IN ACIDIFIED LAKES,

Goeteborg Univ. (Sweden). Dept. of Zoology. M. O. G. Eriksson, L. Henrikson, B-I. Nilsson, G. Nyman, and H. G. Oscarson. Ambio, Vol 9, No 5, p 248-249, 1980. 1 Fig, 36

Descriptors: *Reviews, *Acidic water, *Lakes, *Predation, Fish, Phytoplankton, Aquatic populations, Distribution patterns, Water pollution ef-

A literature review is presented of the altered prey-predator interaction in acidified lakes after the decline or disappearance of fish. When fish were experimentally removed from Lilla Stocke-lidsvatten, a non-acidified lake, changes in the biotic community were similar to those noted in acidified lakes after the elimination of the fish acidified lakes after the elimination of the fish population. Larger ner phytoplankton became more abundant, and small cladocerans were replaced by larger calanids. Small sized, selective predators such as corixids, Chaoborus larvae, and other insects usually preyed on by fish replace fish as the primary predators. Thus, many population structural changes reported in acidified lakes are due to the altered predator-prey interaction. (Small-FRC) W81.01190 W81-01129

THE AQUATIC VEGETATION OF LLAN-GORSE LAKE, WALES, University of Wales Inst. of Science and Technol-ogy, Cardiff. Dept. of Applied Biology. B. A. Cragg, J. C. Fry, Z. Bacchus, and S. S.

Thurley. Aquatic Botany, Vol 8, No 2, p 187-196, April, 1980. 3 Fig, 1 Tab, 21 Ref.

Descriptors: *Lakes, *Eutrophication, *Aquatic plants, *Turbulence, Surveys, Water pollution effects, Recreation, Vegetation effects, Aquatic populations, Sewage effluents, Nutrients, Aquatic algae, Agricultural runoff, Fertilizers, Mapping, Lake morphometry, Hydrography, *Great Britain, Llangorse Lake(Wales).

A survey was conducted of the aquatic vegetation of Llangorse Lake, which receives treated ef-fluents from the Llangorse Village Sewage Plant and is heavily used for recreational purposes. The status of submerged, emergent, and marginal vegetation was evaluated in this lake, which is situated in the Brecon Beacons National Park in Wales. in the Brecon Beacons National Park in Wales. Results were compared with previous studies on lake flora to assess changes that might have occurred over the years. A marked decline was noted in the diversity of submerged macrophytic flora (dominated by Potamogeton pectinatus and Zannichellia palustris), from eight species in 1973 to only monospecific stands of Z. palustris in 1977. Macrophyte decline was attributed to cultured eutrophication processes along with mechanical disturcation processes along with mechanical distur-bances such as boat turbulence. Agricultural runoff contributed many nutrients due to increased use of nitrogenous fertilizers in the catchment area. SYMAP computer mapping was also carried out to produce outlines of the submerged contours. (Geiger-FRC) W81-01131

ANALYSIS OF THERMAL IMPACT IN TIDAL RIVERS AND ESTUARIES.

Giessen Univ. (Germany, F.R.). Physikalisches

J. Hauser, D. Eppel, and F. Tanzer. Water Research, Vol 14, No 10, p 1409-1419, October, 1980. 10 Fig. 7 Ref.

Descriptors: *Temperature, *Model studies, Computer simulation, *Flow, *Turbulence, Velocity, *Tidal streams, Thermal properties, Thermodynamic behavior, Mathematical studies, Estuaries,

A mathematical model has been developed to simulate thermal distributions in esturarine areas with severe reversing flow conditions. The model ac-counts for surface heat transfer, turbulent effects, counts for surface neat transter, turbulent effects, vertical variations in velocity and temperature, and the three-dimensional geometry of the flow region. Four main algorithms are employed: (1) specification of the boundary, (2) determination of all discrete element midpoints within the solution area, (3) construction of discrete elements of irregular geometry matching the curved boundary, and (4) treatment of boundary conditions and numerical solution of the mathematical system of weakly coupled ordinary differential equations derived from the conservation principles for mass and thermal energy. Preliminary results of the simulation were compared with available data for a section of the Elbe River. Although no quantitative agreethe EIDE RIVET. Although no quantitative agree-ment was achieved, comparisons with aerial survey-data showed qualitative agreement with the dimen-sions and behavior of the thermal plume located downstream of the power plant. The model has potential application in predicting thermal plume behavior in power plant designs and in analyses of thermal water pollution. (Titus-FRC) W81-01142

RECOLONIZATION OF STREAMS BY AQUATIC INSECTS FOLLOWING CHANNEL-IZATION,

Clemson Univ., SC. Dept. of Entomology and Economic Zoology.
T. R. White, and R. C. Fox.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150252, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University, Technical Report 87 (Vol I), May, 1980. 120 p, 17 Fig, 14 Tab, 82 Ref. OWRT-A-037-SC(2), 14-34-0001-9043, 14-34-0001-8043, 14-34-0001-7086, 14-34-0001-6042.

Descriptors: *Channeling, *Streamflow, *Drainage effects, *Aquatic insects, *Sampling, Cores, Laboratory tests, Streams, Channel flow, Channels, Regulation flow, Flow, Channel improvement, Stream stabilization, South Carolina, Aquatic life, Aquatic animals, Insects, Coastal plains, Bodies of water, Regions, Research and development.

Recovery, defined as development of an aquatic insect fauna similar to that of the control streams, does not occur in South Carolina streams follow-ing channelization. Five channelized streams and ing channelization. Five channelized streams and two natural streams were sampled over the 1975-1979 period to determine channelization effects on species composition and diversity of aquatic insects in the Piedmont/Coastal Plain regions. Study of stream samples revealed that channelization yields a fauna composed principally of very tolerant or normally pond inhabitating species. Taxa preferring fast currents, vegetation, and low turbidity were rarely found in the channelized streams. Surber square foot and core samplings afforded greatest utility for characterizing stream aquatic insect diversity; kickscreen sampling was found preferable in determined. greatest utility for characterizing stream aquatic insect diversity; kickscreen sampling was found preferable in determining population composition. The results supported the contention that, if a creek must be altered, it should be by means other creek must be attered, it should be by means other than classical channelization for best running water insect faunal preservation. Recommendations to minimize impacts were developed for cases in which a stream must be altered and no alternative exists. (Zielinski-IPA) W81-01157

THE TRUCKEE BASIN FISHERY. 1844-1944. Nevada Historical Society, Reno. J. M. Townley.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C-Effects Of Pollution

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150278, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Nevada, Reno, Desert Research Institute Publication 43008, November, 1980. 88 p. 4 Tab. OWRT-A-096-NEV(1), 14-34-0001-0130.

Descriptors: "History, "Fisheries, "Basins, "Legal aspects, "Water pollution effects, Rivers, Riparian rights, River basin development, Biographies, Planning, Lake fisheries, Stream fisheries, "Nevada, River basins, Institutional constraints, Administration, Water policy, Dams, Bodies of water, Fishing, Water utilization, Legislation, "Truckee River basin(NV).

This second cooperative report of the Nevada Historical Society and the Water Resources Center at the Desert Research Institute builds upon the previous research concerning historical developments in the Truckee River System. A description of the fishery of the Truckee River has been provided from the discovery of the river in 1844 by Fremont, through the next century. Truckee River Fishery importance is evidenced today by litigation and administrative rules that affect the basin water users. The fishery has been discussed in perspective with other historical developments. The chronology of the fishery has been discussed in four principal sections (19th century developments; the Pyramid Lake Fishery before 1900; pulp, paper and pollution; and 1900-1944) using augmentation by 197 footnotes, with predominant references to Nevada statutes and historical issues of the Nevada State Journal and the Reno Evening Gazette. Development of dams and their impacts were discussed, the impacts of industrial pollution and lindian and sport fishing led to trout extinction and decline of the Fishery by 1944. (Zielinski-IPA) W81-01162.

ASIATIC CLAM INVASION: CAUSES AND EF-

FECTS, Virginia Polytechnic Inst. and State Univ., Blacks-

Virginia Polytecinic Inst. and State Univ., Blacksburg. Dept. of Biology.
D. S. Cherry, J. Cairns, Jr., and R. L. Graney.
Water Spectrum, Vol 12, No 4, p 18-24, Fall, 1980.
8 Fig. OWRT-B-101-VA(3).

Descriptors: *Asiatic clam, Toxicity, Bioassay, Biofouling, *Clams, *Clogging, *Intakes, *Power plants, Water temperature, Corbicula, Bioconcentration, Population, Density, New River(VA).

The introduction and subsequent invasion of the Asiatic clam (Corbicula fluminea) in the United States presents a new problem of infestation in power plant intake systems that conventional intermittent chlorination antifouling procedures may not resolve. This article discusses the dynamics of population increases of this organism and presents a case history at the Glen Lyn power plant in southwestern Virginia, where no clams were found before 1975, followed by a rapid population growth in subsequent years. Potential control measures are described with recommendations for future consequences to the power plant industry. W81.01173.

WATER QUALITY OF THE COLUMBIA RIVER,

Environmental Protection Agency, Seattle, WA. Water Div.
D. L. Petke.

In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80. July 1980. p 65-68.

Descriptors: *Columbia River, *Hydroelectric plants, *Water quality control, *Water temperature, Irrigation water, Return flow, Salmonids, Federal Water Pollution Control Act, Oil spills, Pulp wastes, Bacteria.

The Columbia River has experienced some water quality problems over the years which have limited its use for various purposes. Irrigated agriculture and the construction and operation of multi-

purpose and hydro-electric power dams have affected water quality. Industrial development has also produced subtle, long-term water quality changes. In the 1940's and 1950's a significant problem was a slow rise in the overall temperature regimen. The first major problem affecting users was the development of slimes associated with the sheath bacterium Sphaerotilus which coated fishermen's nets and lines. State and federal actions, including the Federal Water Pollution Control Act of 1967 helped solve this problem in the early 1970's. In the 1960's, municipal and industrial waste discharges produced unsafe bacteriological levels; however, this is now controlled, as is a condition known as 'dissolved gas supersaturation' which resulted in losses of 80-90% of downstream migrating salmon. Elevated, almost lethal, water temperatures are still a pervasive problem caused by: (1) dam construction which increases surface area, slows the river flow and produces temperature stratification; (2) point source heat discharges, such as from nuclear power plants; (3) irrigation withdrawals and return flows; and (4) deforestation. To a lesser degree, the water is affected by spills of oil and other hazardous materials. Recent environmental legislation is working toward minimizing these environmental impacts but continued vigilance by the public is also necessary. (Atkins-Omniplan)

5D. Waste Treatment Processes

DESIGN AND SPECIFICATIONS OF A 500 GALLON PER DAY SECONDARY REFRIGERANT FREEZE CONCENTRATION PILOT PLANT TO TREAT AQUEOUS-ORGANIC INDUSTRIAL STREAMS, PHASE 1, PARAMETER HER CES DEITCH PA Esquareign

Rohm and Haas Co., Bristol, PA. Engineering Div.

R. W. Carter

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-147837. Final Report to the Office of Water Research and Technology, June, 1980. 89 p., 55 Fig. 3 Tab., 2 Ref. OWR 1 & 51.5(x) 8566(f), 14-34-0001-8566.

Descriptors: *Waste water treatment, *Pilot plants, *Organic acids, *Separation techniques, *Freezing, *Engineering, Water purification, Equipment, Design, Model studies, Mechanical engineering, Instrumentation, Technology, Economics, Energy, Costs, Ice, Concentration, Butane.

The complete design specifications for a freeze concentration treatment pilot plant proposed by Rohm and Haas are presented. Freeze concentration purification of waste water by 'freezing out' the fresh water as ice can be more economical than distillation, incineration, or biological treatment. Rohm and Haas chose to investigate the purification of a dilute aqueous stream containing 1.5% acetic acid, 0.5% formaldehyde, and 1.0% other organic acids. The pilot plant is a two-stage, secondary refrigerant, direct contact freezing process with indirect melting and is an energy integrated system. The acetic acid solution is frozen by sparged liquid butane vapor and since acetic acid and water form a simple eutectic, the water freezes out of the solution as pure ice. The ice is separated out and melted using the heat from the condensing butane. The pilot plant was designed to produce 500 gallons per day of fresh water from a 50% acetic acid solution. The pilot plant length is 37 feet and the estimated cost of a trimmed pilot plant is \$480,981. The materials balance, engineering drawings and instrument specifications, cost estimates, and construction of a scale model have been completed. (Sidney-IPA)

CHEMICAL DOSAGE CONTROL FOR PHOS-PHORUS REMOVAL. Pollutech Pollution Advisory Services Ltd., Oak-

ville (Ontario). Environmental Protection Service, Ottawa, Ontar-

Environmental Protection Service, Ottawa, Ontario, Canada, Training and Technology Transfer Division (Water). Canada-Ontario Agreement on

Great Lakes Water Quality Research Report No 4, 1976. 80 p, 43 Fig, 6 Tab, 7 Ref, 3 Append.

Descriptors: *Phosphorus removal, *Waste treatment, *Monitoring procedures, *Chemical dosage controls, Jar-test studies, Full-scale treatment, Data collections, *Great Lakes, Water quality.

This project was undertaken to determine whether a simple monitoring procedure could be utilized to control chemical addition in municipal waste treatment plants. It was intended to demonstrate that proportional control of chemical feeding would be economically advantageous and to determine which specific parameters could be monitored to enable chemical dosage control and at which locations within a treatment plant. A review of all available information on chemical dosage control programs underway in the United States was made, and data from the Ontario Ministry of the Environment based on observations as treatment plants were analysed in detail. No data were found upon which chemical dosages and phosphorus residuals could be compared with other related wastewater parameters. Bench-scale jar studies and measurements at a full-scale plant during chemical addition were therefore conducted to obtain the necessary data. (WATDOC)

REPORT OF THE URBAN DRAINAGE SUB-COMMITTEE PROJECTS CONDUCTED 1972-

Environmental Protection Service, Ottawa (Ontario). Water Training and Technology Transfer Div. Canada-Ontario Agreement on Great Lakes Water Quality Research Report No 101, 1980. 134 p, 3 Append.

Descriptors: *Urban drainage, *Stormwater management, *Chemical treatment, *Phosphorus removal, *Wastewater treatment, Sewage treatment plants, Sewage sludge disposal, Organic contaminants, Toxic substances, Pollution abatement, Storm sewers, Combined sewers, *Great Lakes, Water quality, Projects.

This report of the Urban drainage subcommittee for Great Lakes Water Quality gives 36 detailed project descriptions and summaries. The terms of reference are: to define the magnitude of the pollution due to storm water in the Great Lakes Basin; to establish priorities and schedules for studies directed toward potential solutions to storm water pollution problems; and to develop a strategy for implementing solutions. (WATDOC) W81-01019

PILOT SCALE EVALUATION OF PHYSICAL-CHEMICAL WASTEWATER TREATMENT SYSTEM FOR COMBINED SEWER OVER-FLOWS.

Pollutech Pollution Advisory Services Ltd., Oakville (Ontario).

To primary bibliographic entry see Field 8B.
W81-01020

BORON RECOVERY BY REVERSE OSMOSIS, Westinghouse Research and Development Center, Pittsburgh, PA.

Int. K. Bansal. Industrial Wastes, Vol 26, No 6, p 12-13, 24, 26, 31, November/December, 1980. 6 Fig, 4 Tab, 1 Ref.

Descriptors: *Reverse osmosis, *Nuclear reactors, *Boron, Ion exchange, Waste water treatment, Water purification, Ions, Treatment facilities.

Chemical coagulation, reverse osmosis, and ion exchange processes were evaluated for the removal of contaminants, primarily silica, chloride, calcium, magnesium, and sodium. Up to 67% of the boric acid was recovered from water leaked from the primary loop of an operating nuclear pressurized water reactor system using a combination of reverse osmosis and ion exchange. The volume of contaminating ions was reduced 98%. A proposed system includes filtration, a three stage reverse cosmosis membrane system, and final polishing by a single-stage dual bed ion exchange. The final efflu-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Waste Treatment Processes—Group 5D

ent can be concentrated in a boron evaporator to a level of 4% boric acid. (Small-FRC) W81-01056

PLATING WASTE TREATMENT,

T. V. Belmont, and J. G. Cunniff. Industrial Wastes, Vol 26, No 6, p 14, 27, November/December, 1980. 1 Fig, 1 Tab.

Descriptors: *Industrial wastes, *Metals, *Waste water treatment, Copper, Recycling, Treatment facilities, Costs, Metal plating industry, Cyanide.

The waste treatment facilities at the General Metal Finishing Company plant in Attleboro, Massachu-setts, are described. Cyanide-bearing rinse waters drain by gravity into a sump after copper, silver, and cyanide reverse cleaners. The rinse waters are mixed in a Cyanide I reaction vessel with various treatment chemicals including 20-25% solutions of sodium hydroxide and hypochlorite. The rinse waters then flow to Cyanide II where the pH is lowered to 7.5-8.5 with sulfuric acid. The clarified effluent is discharged into a sewer. The sludge is disposed of by a licensed waste hauler. The treat-ment plant cost \$208,000 (1978), and the recovery of metals provides an income of approximately \$50,000 per year. (Small-FRC) W81-01057

SEWAGE: WASTE OR RESOURCE, Wisconsin Univ.-Madison.

C. Hamlin.

C. Hamin. Environment, Vol 22, No 8, p 16-20, 38-42, October, 1980. 4 Fig, 27 Ref.

Descriptors: *Sewage treatment, *Sludge disposal, *Recycling, Toxicity, History, Pathogenic bacte-

While some cities recycle de-watered sludge as fertilizer, there are hygienic and toxicity problems with some sewage wastes. Raw sewage contains pathogenic bacteria, most of which are killed by pathogenic bacteria, most of which are killed by treatment or exposure to sunlight and air. Industri-al wastes add heavy metals and other toxins to sewage, and this threat must be controlled either by eliminating industrial wastes or monitoring plant uptake of the toxins. The problem of rivers rolluted by discharged sewage was not solved by plant uptake of the toxins. The problem of rivers polluted by discharged sewage was not solved by any of the early sewage recycling processes such as the ABC method, and the European sewage farms ended with the advent of nitrate fertilizers. Today, knowledge is available for treating sewage, but modern man has forgotten that sewage is a resource and should be returned to the land. (Small-FRC) W81-01064

DIFFERENT METHODS TO EXTRACT SEWAGE SLUDGE FOR THE CULTIVATION OF CHLORELLA PYRENOIDOSA, Chinese Univ. of Hong Kong, Shatin. Dept. of

Biology.
M. H. Wong.
Archiv fur Hydrobiologie, Vol 88, No 4, p 426-438, June, 1980. 6 Fig. 4 Tab, 25 Ref.

Descriptors: *Separation techniques, *Sewage sludge, *Chlorophyta, Activated sludge, Nutrients, Nitrogen, Phosphates, Aquatic algae, Proteins, Laboratory tests

Three different techniques were examined for extracting sewage sludge for the purpose of cultivating the unicellular green algae, Chlorella pyrenoidosa. Samples of activated and digested sludge from the Chinese University Sewage Treatmet Plant were extracted by submersion into distilled Plant were extracted by submersion into distilled water at 22C for 24 hours, dispersion into distilled water by an electric blender for 20 minutes, or soaking in 0.1 M ammonium acetate for 24 hours at 22C. Extracts obtained from sludge subjected to these three methods were used at 1%, 2%, and 4% concentrations in algal media to test the growth rate of C. pyrenoidosa. Results of cell counts taken at 2-day intervals for 2 weeks showed that only the media containing sludge extracts, obtained with media containing sludge extracts obtained with ammonium acetate gave poor algae growth. The media made up with sludge extracts obtained from

the other two procedures gave algal growth rates similar to that of control media. These findings were attributed to the high NH3-N levels and low pH of the ammonium acetate extracted sludge expri or the ammonium acetate extracted sludge extracts. Digested sludge extracts had lower levels of macronutrients such as water-soluble phosphate and nitrogen, and therefore yielded algal cells containing a lower protein content than those grown on extracts of activated sludge. (Geiger-FRC) W81-01069

SLUDGE DEWATERING, Pierson and Company, Manchester (England). H. G. W. Pierson. Water and Waste Treatment, Vol 23, No 9, p 41-42, 44, September, 1980.

Descriptors: *Sludge treatment, *Dewatering, *Drying, Incineration, Waste treatment, Sludge, Filters, Filtration, Screens, Centrifugation.

Considering the cost factor alone, it is usually advantageous to treat sludge on site if it arrives in quantities in excess of 2,000 gallons per week. While it was formerly customary to dewater through incineration whenever possible, increased fuel costs have now restricted this practice to those substances for which it is required by law or for which there is no other possible treatment. The thought that the drier the cake, the lower the overall cost, is criticized. Slightly wet cakes pack much better, and the actual disposal cost is shown to be practically identical whether the cakes are very dry or slightly wet. Types of sludges include colloidal, semi-colloidal, granular, crystalline, fibrous and coarse solids. In most cases it is advantageous to thicken a sludge prior to filtration or brous and coarse solids. In most cases it is advantageous to thicken a sludge prior to filtration or separation. Two basic methods for dewatering sludge are filters and gravitaional force. Types of equipment to be considered include filter presses, rotary vacuum drum or rotary vacuum belt filters, gravity belt and compression belt filters, horizontal vacuum belt filters, sock filters, centrifuges or screens. The choice of an effluent filter is extremely important, as important as choosing a proper filter for process slurries. (Baker-FRC)

CONCEPTION OF PLANS FOR A MARSEILLE PURIFYING FACILITY. (CONCEPTION DU PROJET DE LA STATION D'EPURATION DE MARSEILLE),

Inspecteur General des Services Techniques, Mar-

Inspecteur General des Scille (France). G. Lacroix, M. Duclary, and B. Hoyaux. Progress in Water Technology, Vol 12, No 4, p 731-755, 1980. 11 Fig, 1 Tab.

Descriptors: *Waste water treatment, *Sewage treatment, *Water treatment, Municipal wastes, Water pollution, Sludge treatment, Water pollution, Marseille(France), France.

Plans for waste water treatment facilities for the city of Marseille, population 1 million, were developed in order to reduce pollution of the Mediterraoped in order to reduce pollution of the Mediterra-nean Sea. Designers considered the nature of the sea, the influent, the sewage system, the water courses in the area, water and sludge treatment, future sites for treatment plants, and sludge utiliza-tion. Following these studies, the city decided to build an underground primary sedimentation water treatment plant in the urban area and a sludge treatment plant outside the city. The plant will be in service in 1983. Costs of construction are estiin service in 1983. Costs of construction are esti-mated at 520 million francs. If periodic studies of the sea indicate the necessity for a second stage treatment facility, this will be considered. (Cassar-FRC) W81-01078

ADVANCED PRIMARY TREATMENT FOR OCEAN DISCHARGE, Towill (R. M.) Corp., Honolulu, HI. S. T. Yamanaka, Jr., O. E. Albertson, and R.

Progress in Water Technology, Vol 12, No 4, p 653-683, 1980. 18 Fig, 7 Tab.

Descriptors: *Sewage treatment, *Honolulu, *Sand Island, *Municipal wastes, *Flotation, Waste water

treatment, Sludge treatment, Clariflotator, Outlets, Oceans, Sea water, Hawaii, Air flotation, Sludge disposal, Waste treatment, Milan, Illinois, Burlingame(CA), California.

Some cities which face mandatory secondary treatment before discharging their waste water into the ocean are questioning the high costs and the real benefits of this proposed procedure. The paper discusses types of waste and their possible methods of treatment. Details of improved facilities at Sand Island, waste water treatment plant for the City of Honolulu, are given. The key to the Sand Island plant design is an advanced primary treatment stage using six 46 meter diameter floatation-clarifiers to remove light suspended solids and flotables by dissolved air flotation. Heavy materials settle to the bottom of the tank. The outfall, deepest in the world, is 74 meters deep and 4,240 meters long. Detailed operating data for the plant, which started operation in late 1978, are presented. Other flotation-clarification case histories discussed are Milan, Illinois, and Burlingame, California. Studge handling and disposal methods are discussed. (Cassar-FRC) Some cities which face mandatory secondary treat-

NEW CONCEPTS FOR THE TREATMENT OF SEWAGE DISCHARGED TO THE SEA. Hydrotechnic Corp., New York

R. Nebolsine. Progress in Water Technology, Vol 12, No 4, p 639-652, 1980. 5 Fig, 11 Ref.

Descriptors: "Waste water treatment, "Sewage treatment, "Filtration, "Municipal wastes, "Water pollution sources, Coagulation, Effluents, Cleveland, Coasts, Sea water, Contact Coagulation-Ultra High Rate filtration.

The Contact Coagulation-Ultra High Rate filter system is applicable to treatment of sewage before discharge into the sea. Sewage, after passing bar racks, is elevated to pass through rotary screens. After a very short coagulation treatment, the water passes through filters. Effluent is then disinfected with ozone or chlorine, if desired. This process, tested in the city of Cleveland, removed 70% to 80% of suspended solids; 70% to 90% of oils, heavy metals, phosphates, etc.; and 58% to 72% BOD. There are many advantages to the ultra high rate filtration system: it removes many considerations. high rate filtration system: it removes many con-taminants to the same degree as does secondary taminants to the same degree as does secondary treatment at lesser cost, reduces pathogens, occupies 6 to 10% of the area of an equivalent secondary plant, requires 20 minutes total treatment time versus the conventional 5 to 8 hours, requires 0.06 versus the conventional 3 to a hours, requires own kilowatt hours of energy per cubic meter treated, treats storm runoff easily, occupies an enclosed building, and produces sludge which can be pumped inland for further treatment. Diagrams of plants with capacities of 25, 50, 100, and 200 million gallons per day are provided. (Cassar-FRC) W81-01080

IMPROVED WASTEWATER TREATMENT FOR HOLIDAY RESORT TOWNS ON THE

COAST, M. E. Garrett, and P. del Rio. Progress in Water Technology, Vol 12, No 4, p 723-730, 1980.

Descriptors: *Waste water treatment, *Municipal wastes, Sewage treatment, *Oxygen requirements, *Pumping plants, *Respiration, Water treatment, Aerobic treatment, Respiration, Water treatment, Megox process, Primox process

A typical waste water treatment facility for a seaside resort town located near a small river is seaside resort town located near a small river is described. Sewage is oxygenated within the sewer at a pumping station located at the present collection point. Sewage is pumped upgrade, preferably along a river course, to a treatment plant outside of town. After primary settlement, use of filtration, activated sludge treatment, or the Megox process is possible. In the last-mentioned process, oxygenated sludge is recirculated in the lower part of the tank, the upper part acting as a clarifier. The resulting sterile effluent can be transferred through pipes adjoining the river course and be discharged

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

at sea. A formula for daily oxygen requirements is given. This considers respiration rate, diameter of the main, and sewage retention time in the main. Presence of sulfide requires additional oxygen. The advantages of this process for resort towns are its adaptation to wide fluctuations in population, low capital costs, and prevention of sulfide odor. (Cassar-FRC) W81-01081

WASTEWATER TREATMENT EVALUATED BY FORCE ACCOUNT, PROCESS

Montana State Univ., Bozeman. For primary bibliographic entry see Field 6B. W81-01086

HYDRAULIC EFFICIENCY OF WASTEWATER LAGOON SYSTEMS.

Hazen and Sawyer, Hollywood, FL. G. W. Bors, and P. E. Robinson. Tappi, Vol 63, No 11, p 149-151, November, 1980. 6 Fig. 3 Tab.

Descriptors: *Detention reservoirs, *Pulp wastes, Pulp and paper industry, *Waste storage, *Waste water treatment, *Lagoons, Chemical wastes, In-dustrial wastes, Oxidation lagoons, Stabilization, Activated sludge, Sludge treatment, Waste treat-ment, Aeration, Ponds, Performance, Efficiencies.

Four case studies of pulp and paper mill waste water lagoon systems illustrate the problem of short-circuiting, which results in reduced hydraulic detention times and decreased treatment efficiency. Corrective measures are described. In each situation time-of-travel and circulation studies were performed using Rhodamine WT dye and a continuous flow cell fluorometer with chart recorder. In the first case, an aerated stabilized basin and oxidation pond system, addition of diversion curtains changed circulation and improved performance. The second system consisted of 6 inter-connected natural ponds. Surface baffling was suggested to remedy a temperature stratification condition where the warm waste water remained within the upper 4 feet of the pond. Case 3 was a shallow aerated stabilized basin which demonstrated 72% volume utilization and a 26 hour actual retention time (theoretical, 36 hours). This pond contained several strategically located rotating aer-ation units. Two additional units were scheduled for installation. The last case, an activated sludge aeration tank, was studied after installation of additional baffles, submerged static mixers, and a return sludge system produced an overall volume utiliza-tion of 92%. (Cassar-FRC) W81-01093

IRRIGATION OF INTENSIVELY CULTURED PLANTATIONS WITH PAPER MILL EFFLU-

North Central Forest Experiment Station, Rhinelander, WI.

For primary bibliographic entry see Field 3C. W81-01094

DIGESTER METHANE UTILIZATION CAN BE OPTIMIZED, Envirex Inc., Waukesha, WI.

P. G. Baumann.

Water and Sewage Works, Vol 127, No 11, p 44, 45, 66-68, November, 1980. 2 Fig.

Descriptors: *Digestion, *Sludge digestion, *Gas, *Energy conversion, Methane, Heat, Electric power production, Electric generators.

Digester gas, formerly seen as an energy source not worth exploiting, can be used to generate electric power, power boilers to heat sludge and buildings, and run incinerators. Detailed information for a 5 million gallon per day plant is given, with energy balances calculated for electric power generation and digester heat requirements. Suggestions for efficient gas storage and boiler and engine design are described. (Cassar-FRC) W81-01095

LOS ANGELES, GLENDALE SHARE REUSE PLANT'S PROVISIONS, Water and Sewage Works, Vol 127, No 11, p 16, 69, November, 1980.

Descriptors: *Water reuse, *Sewage treatment, *Glendale(CA), *Los Angeles, Waste water treatment, Municipal wastes, Sewage treatment, Performance, Sedimentation, Aeration, Filtration,

Detailed information on the design and operation of the Los Angeles-Glendale Water Reclamation Plant is presented. This plant, which began functioning May 25, 1976, provides hydraulic relief for the North Outfall Sewer, eliminating an immediate need for increasing sewer capacity, and reclaims waste water for irrigation and industrial use. Capacity of the plant is 20 mgd, annual operation costs are 1 million dollars, and construction costs costs are I million dollars, and construction costs were 13.6 million dollars. Primary, secondary and tertiary treatments are done. After solid materials are removed by screening and primary sedimentation, activated sludge processing takes place in 6 aeration tanks (240 x 32 x 16 feet) and 10 secondary sedimentation tanks (170 x 20 x 9 feet). Tertiary treatment consists of filtration and chlorination. The city of Glendale uses a major proportion of this processed water for park irrigation and for operation of its steam power plant. (Cassar-FRC)

SOLIDS-CONTACT CLARIFICATION BRINGS OUT BEST OF TRICKLING FILTERS, Brown and Caldwell, Eugene, OR.

D. F. Norris.

Water & Sewage Works, Vol 127, No 11, p 28, 29, 59, 60, November, 1980. 2 Fig, 2 Tab.

Descriptors: *Waste water treatment, *Sewage treatment, *Solids contact, *Trickling filters, Processes, Sludge treatment, Filtration, Corvallis(OR), Municipal wastes.

The capacity of the Corvallis, Oregon, waste water treatment plant was doubled to 10 mgd by incorporating the trickling filter process with solids contact clarification, replacing the activated sludge process as of January, 1979. This process has about half the energy requirements of the activated sludge method. The key to this process is activated sludge method. The key to this process is sludge recirculation and aeration, coupled with new solids-contact clarifiers, which are deeper than the conventional ones and have a center well. Here, mild stirring promotes agglomeration of fast-settling solids. High quality effluent is produced by maintaining circulated solids in an aerobic state for one fifth of the process time. The sludge produced is so dense that it can be wasted directly to the primary sedimentation tanks, where sludge densities are routinely 5.5 to 6.5%. (Cassar-FRC) W81-01097

ACTIVATED SLUDGE WASTEWATER TREAT-MENT--STOICHIOMETRIC RELATIONSHIPS,

MENI-STOICHIOMETRIC RELATIONSHIPS, Virginia Polytechnic Inst. and State Univ., Blacks-burg. Dept. of Civil Engineering. J. H. Sherrard. Journal of Chemical Technology and Biotechnol-ogy, Vol 30, No 8, p 447-452, August, 1980. 7 Fig, 3 Tab, 6 Ref.

Descriptors: *Activated sludge, *Waste water treatment, *Model studies, *Mathematical models, Sewage treatment, Effluents, Design, Nitrification, ical oxygen demand, Oxygen requirements,

A mathematical model based on kinetic and stoichiometric principles is used to formulate and solve a sample problem in the treatment of activated sludge waste water. This technique can help the engineer to compare treatment alternatives during engineer to compare treatment alternatives during the design stage and the plant operator to attain maximum efficiency during operation. Graphs illustrate the following relationships as function of mean cell residence time in days: effluent COD and nitrification, daily waste sludge production and oxygen requirements, % carbon distribution, % nitrogen, oxygen uptake per day per pound of activated sludge under aeration, and net change in alkalinity. (Cassar-FRC) W81-01105

SCREENING AT A FELLMONGERY. Effluent and Water Treatment Journal, Vol 20, No 9, p 457, September, 1980.

Descriptors: *Effluents, *Water pollution sources, *Screens, Animal wastes, Discharge(Water), *Industrial wastes.

Problems with blockage and choking of effluent drainage lines and pumps at the Retford sheep skin processing plant were solved by the installation of a screen just below ground level. As the effluent cascades into the screen drum the solid fraction is retained inside the drum while the liquid passes retained inside the drum while the induit passes through. The effluent drops from the dolly (primary skin cleaning vas) to the screen drum about every 2 hr during the day, at which time the unit handles about 18,000 liters over a 30 min period. The system has been in operation about 7 mo and has overcome most of the problems that had been encountered in processing this difficult effluent.

FLOW EQUALIZE ALL INFLUENT, Holloway (Max) Engineering Co., Muskogee, OK. J. Updike. Water and Wastes Engineering, Vol 17, No 10, p 20-23, October, 1980. 2 Fig. 5 Tab.

Descriptors: *Treatment facilities, *Inflow, *Flow rates, Flow control, *Waste water treatment, Trickling filters, Wet filters, Wet seasons, Basins, Oklahoma, Municipal wastes.

In-line flow equalization basins were installed in the Muskogee, Oklahoma waste water treatment plant to equalize wet weather flows to within existing plant capacity. The plant, a 10 mgd twoeasting plant capacity. The plant, a to might work stage trickling filter facility, never consistently met NPDES requirements. An infiltration/inflow analysis led to the in-line flow equalization design. The plant passes dry and wet weather flows through o basins at a preset rate and gains the added benefits of emergency storage capacity and grit removal. The two basins are each 19 ft deep, and have a total usable volume of 35,000,000 gal each. Effluent from the basins is controlled by a 24 inch venturi tube in the return line to the main plant. (Small-FRC) W81-01119

PHILOSOPHY OF THE SAFE DRINKING WATER ACT AND POTABLE REUSE,

North Carolina Univ. at Chapel Hill

D. A. Okun.

Environmental Science & Technology, Vol 14, No 11, p 1298-1303, November, 1980. 13 Ref.

Descriptors: *Potable water, *Water reuse, *Legis-Descriptors: Protable water, "Water reuse, "Legislation, "Public health, Reviews, Waste water, Water utilization, Water treatment, Disinfection, Tertiary treatment, Organic compounds, Water supply, Groundwater, Federal Water Pollution Control Act, Water pollution, Water quality.

A review of the principles of obtaining safe drinking water is presented, along with a historical outline of public health considerations which led to the adoption of these principles. Sanitary surveys mandated by the US Public Health Service in 1962 mandated by the US rubin relatin service in 1962 stressed the identification of sources of pollution and the obtainment of drinking water from the safest possible sources. Prior to the 1962 enactments, little attention was paid to the adequacy of the supply, a factor of major concern to the consumers. While water reuse along rivers increased water supplies, it often caused concentration of pollutants at downstream sites. In the 1800's, relocation of water intake sources in London to sites farther upstream on the River Thames led to refarther upstream on the River Thames led to re-ductions in outbreaks of cholera. The use of chemi-cals for water disinfection in the post-World War II era offered protection against infection from reused water supplies. Reduction of harmful organ-ic compounds in potable water supplies could be achieved by chemical treatment of drawing from sed water sources. Reuse of nonpotable

Waste Treatment Processes—Group 5D

was stressed to free potable water supplies from unnecessary contact with man-made pollutants.

Problems associated with rendering waste waters

potable through technological treatments are many. US government policy stressing research in the treatment of waste water precludes funding for studies of nonpotable water reuse. (Geiger-FRC)

UTILIZATION OF THE WHITE-ROT FUNGUS SPOROTRICHUM PULVERULENTUM FOR WATER PURIFICATION AND PROTEIN PRODUCTION ON MIXED LIGNOCELLULOSIC WASTEWATERS

Swedish Forest Products Research Lab. Stockholm. Dept. of Chemistry.
M. Ek, and K-E. Eriksson.

Biotechnology and Bioengineering, Vol 22, No 11, p 2273-2284, November, 1980. 3 Tab, 22 Ref.

Descriptors: *Fungi, *Industrial wastes, *Proteins, Industrial water, *Waste water treatment, Laboratory tests, Cellulose, Feeds, Biochemical oxygen demand, Sweden.

A laboratory-scale continuous process that allows A laboratory-scale continuous process that allows a direct conversion of polymeric material into easily harvested fungal protein was developed. This process, which utilizes white-rot fungus Spor-Inis process, which utilizes white-for trugus spor-ortrichum pulverulentum, produces protein and pu-rifies water. Tests on waste water from a fiber-board factory indicated that the degree of water purification is dependent upon residence time. Long residence times cause all carbohydrates and Long residence times cause all carbohydrates and most of the lignin structures to be degraded, but result in low productivity. Production of mycelium for feedstuff requires a holding time of about 15 hr, corresponding to a 60% BOD reduction. If water is recirculated, the 15 hr residence time might be sufficient to keep the content of soluble organic matter at an acceptable level. (Small-FRC) W81-01126

SAND CAMBISOL FUNCTIONING AS A FILTER THROUGH LONG-TERM IRRIGATION WITH WASTEWATER, Technische Univ., Berlin (Germany, F.R.). H-P. Blume, R. Horn, F. Alaily, A. N. Jayakody, and H. Meshref. Soil Science, Vol 130, No 4, p 186-192, October, 1980. 6 Fig. 3 Tab, 8 Ref.

Descriptors: *Waste water disposal, *Cycling nutrients, *Filtration, Forests, Nutrients, Irrigation, Forest soils, Dynamics, Drainage, Environmental effects, Flooding, Leaching, Estimating equations, Rainfall, Air pollution, Soil horizons.

Waste water disposal by irrigation onto arable land provides water purification before the water is returned to the natural reservoirs and recycling of nutrients. Comparisons were made of a cambisol supplied with waste water since 1900 and a similar soil from under a pine forest with no application of waste water. Parameters examined in each soil were total porosity, pore size distribution, hydrau-lic conductivity, nitrogen forms, exchangeable ions, and heavy metals. No great differences were noted in texture and bulk density of the two soils. Long-term waste water irrigation of the cambisol caused a slightly increased organic content as well as higher levels of phosphorus and nitrogen. Copper and zinc were also highly retained by the cambisol when compared to the forest soil. Manga-nese and zinc were lost in the subsoil of the cambisol due to low oxidation potentials. Both sites underwent changes in elemental content due to intense air pollution and the effects of rainfall. Changes in soil content of elements were calculat-ed by a mathematical formula based on soil horizon data. The dynamics of flooding and drainage at the two sites and their effects on soil composi-tion were also investigated. Results of these studies indicate sharp reductions in the filtering of iron and manganese nutrients. (Geiger-FRC) W81-01130

STORAGE-INDUCED DENITRIFICATION USING SEQUENCING BATCH REACTOR OP-ERATION,

Maryland Univ., College Park. Dept. of Civil Engineering. J. E. Alleman, and R. L. Irvine. Water Research, Vol 14, No 10, p 1483-1488, Oc-tober, 1980. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Denitrification, *Wastewater treatment, *Organic compounds, *Carbon, *Bacteria, Nitrogen, Design criteria, Sewage bacteria, Nitrite,

Bacterial storage may substitute for raw-waste organic carbon components as the electron-donor substrate required for denitrification. Bench-scale studies of storage induced denitrification were con-ducted using a sequencing batch reactor. By operating the reactor in a mode conducive to the development of cellular storage, the system maintained a consistent 92% or greater reduction in total nitrogen without a carbon supplement. Depletion of the cellular glycogen reserve was observed during the denitrification reaction. This system has potential application to advanced wastewater treatposential application to advanced wasfewater freat-ment. It suggests that dentifification can be main-tained solely on the basis of endogenous activity. (Titus-FRC) W81-01132

ENHANCEMENT OF PCBS BIODEGRADA-TION BY SODIUM LIGNINSULFONATE, National Water Research Inst. Burlington (Ontar-

D. Liu. Water Research, Vol 14, No 10, p 1467-1475, Oc-

tober, 1980. 7 Fig, 12 Ref.

Descriptors: *Biodegradation, *Bacteria, *Gaschromatography, Cultures, Water analysis, *Polychlorinated biphenyls, Surfaces, Growth rates, Oxidation, Microbial degradation, Chlorination, Boundary processes

Microscopic examinations and growth studies indi-cate that biodegradation of commercial PCBs is enhanced by the use of sodium ligninsulfonate in the culture medium of Pseudomonas bacteria. Sodium ligninsulfonate stimulates the bacterial growth rate and biodegrades without being used itself. It thus allows cells to overcome the substrate limiting factor of surface area. Analyses of the limiting factor of surface area. Analyses of the culture broth by gas chromatography revealed that the bacteria could degrade 300 parts per million of Aroclor 1254 after 18 days incubation. Manometric data demonstrate that lower chlorinated PCBs are oxidized faster than higher chlorinated PCBs. Commercial preparations of PCBs are mixtures of many different isomers with varying chlorine content. The properties of these mixtures are vastly different and complex to study. Since PCBs are among the most persistent lipophilic substances found environmentally, the significance of interface control on biodegradation rates has potential application for other lipophilic compounds in the aquatic environment. (Titus-FRC)

ULTRAFILTRATION PROCESSES FOR POL-LUTION CONTROL AND CHEMICAL REUSE IN THE TANNING INDUSTRY,

Naples Univ. (Italy). Facolta di Ingegneria. E. Drioli, and B. Cortese. Desalination, Vol 34, No 1/2, p 131-139, July/ August, 1980. 3 Fig. 5 Tab, 3 Ref.

Descriptors: *Filtration, *Waste water treatment, *Industrial wastes, Pilot plants, Reclaimed use, Water reuse, Effluents, *Water quality control, Methodoloy, Organic compounds, Recirculated water, Recycling.

Experiments were conducted to determine the effectiveness of ultrafiltration in treatment of tannery fectiveness of ultrafiltration in treatment of tannery wastes. Dehairing and degressing produce the most highly polluting wastes of the tanning process. Effluents contain high levels of sulfur, amines, mercaptans and sludges from skin and hair. Non-cellulosic membranes able to function in the pH range from 2 to 13 and at temperatures up to 50C were used in two pilot ultrafiltration plants. Experiments were conducted using tubular membranes, continuous recycling and continuous feed-

ing of waste water, and pressures of 3.2 atmospheres and 3.0 atmospheres. Results show a decrease in the selectivity of the membrane toward grease removal with increasing temperature, accompanied by increased permeation flow. In the experiments in which the concentrated solution experiments in which the concentrated solution was continuously recycled, the flux decline was rapid, dropping from 150 liters per hour to 10 liters per hour in 3 hours. Ultrafiltration of dehairing effluents produced a near zero rejection towards electrolytic species and produced a high rejection towards proteinaceous and colloidal substances. The simplicity of ultrafiltration and the possibility of controlling the concentration and the possibility of controlling the concentration of the chemical species in the permeate by varying membrane type and process conditions make this method competitive with other conventional methods. (Titus-FRC) W81-01139

RESIDENCE TIME DISTRIBUTION IN SUB-MERGED BIOFILTERS, Technical Univ. of Denmark, Lyngby. Dept. of

Sanitary Engineering.
M. Riemer, G. Holm Kristensen, and P. Harremoes.

Water Research, Vol 14, No 8, p 949-958, August, 1980. 12 Fig. 3 Tab, 12 Ref.

Descriptors: *Model studies, *Denitrification, *Biological membranes, *Filters, Mathematical studies, Biological treatment, Tracers, Bubbling, Nitrogen, Adsorption, Nitrates, Kinetics.

When kinetic models for chemical or biological When kinetic models for chemical or biological reactions are evaluated the residence time distributions are often utilized. Often results from tests on submerged biological denitrification filters deviate systematically from those expected for the simple flow models by exhibiting pronounced tailing. Tailing also makes the estimation of the Peclet number from the variance of the response curve very difficult or impossible. A mathematical model very difficult or impossible. A mathematical model is presented in which the head of the distribution results from the usual longitudinal dispersion in a porous medium. In this system a group of pulse response curves consisting of a leading head are generated (almost Gaussian) and are followed by a tail with exponential decay. The characteristics of the model curves were identical to those formulational decay. the moder curves were identicated to those formular-ded under experimental conditions. Tests with a dye tracer showed marked adsorption effects. The tracer was useful in monitoring over-all perfor-mances of submerged filters and determining the longitudinal dispersion and volume occupied by biofilm and bubbles. Non-bubbling trials using tri-tium as tracer gave little deviation between pulse and sten-down experiences with peared to talling tium as tracer gave little deviation between pulse and step-down experiments with regard to tailing due to irregular biofilm morphology. When signifi-cant sections of the surface are bared by nitrogen bubbling, the degree of coverage and mean biofilm thickness cannot be estimated with great certainty. (Geiger-FRC)

THE THERMAL SENSITIVITY OF NITRIFI-CATION AS A FUNCTION OF THE CONCENTRATION OF NITROGEN SUBSTRATE,

Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering

A. V. Quinlan. Water Research, Vol 14, No 10, p 1501-1507, October, 1980. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Thermal properties, *Oxidation, Ni-trite, *Mathematical studies, Nitrogen, *Nitrifica-tion, Ammonia, *Bacteria, Temperature, Chemical reactions, Microorganisms, Waste treatment, reactions, Microon Chemical degradation

The joint influence of substrate concentration and temperature on bacterially mediated ammonia and nitrite oxidation is analyzed using rate laws from the literature. Results demonstrate that optimum temperature relations offer a means for controlling thermally induced accumulations of nitrites in nitnermaily induced accumulations on intrites in in-trifying systems whose temperatures can be manip-ulated. This has potential application in small sewage treatment plants, cooling towers and ponds. At present temperature control is practiced in several industrial wastewater treatment plants, but is not economically feasible in most domestic

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

wastewater treatment plants because of the large flows involved. Thermal enrichment of nitrifying systems poses a severe ecotoxicological hazard, because nitrites at concentrations as low as .5 parts per million are carcinogenic and anoxogenic and because concentrations increase substantially as temperature increases. (Titus-FRC) W31-01145

COMMENT.

CUMMEN1, Proctor and Gamble Ltd., Newcastle-upon-Tyne (England). A. P. Walker, W. F. Holman, and R. H. Wendt. Water Research, Vol 14, No 1, p 95-101, January, 1980. 15 Ref.

Descriptors: *Sludge treatment, *Heavy metals, *Water pollution sources, *Laboratory tests, *Onsite investigations, Publications, Suspended solids, Detergents, Chemical wastes, Sewage treatment, Biodegradation, Water properties, Water quality.

ents concerning the findings of Stoveland et al (1979) on the laboratory removal of nitrilotriace-tate from artificial sewage are presented. A review of the scientific literature establishes that nitrilotriacetate is effectively removed during sewage tracctate is entertively removed ourng sewage treatment over a wide range of conditions, including soft water, and that it does not cause increased metal pollution of receiving waters. Under laboratory conditions, nitrilotriacetate can solubilize metals. However, under practical conditions, concentrations of cadmium, nickel and mercury in domestic wastewater are low, the aerobic biologi-cal wastewater treatment systems are capable of removal rates greater than 90%, and nitrilotriace-tate concentrations in effluent are insignificant. It is suggested that the laboratory results of Stoveland et al. omitted data on suspended solids which are significant in heavy metal removal and that the laboratory conditions are not comparable to municipal conditions. Statistical evaluations were also absent. Nitrilotriacetate has practical application as a detergent builder. (Titus-FRC) W81-01146

RESPONSE TO COMMENTS RESPONSE TO COMMENTS BY A. P. WALKER, W. F. HOLMAN AND R. H. WENDT, Imperial Coll. of Science and Technology, London (England). Dept. of Public Health Engineering. S. Stoveland, J. N. Lester, and R. Perry. Water Research, Vol 14, No 1, p 103-107, January, 1990.

Descriptors: *Sewage treatment, *Detergents, *On-site investigations, *Laboratory tests, Biodegradation, Publications, Heavy metals, Sludge treatment, Suspended solids, Chemical wastes, Water properties, Water quality.

Use of nitrilotriacetic acid as a detergent builder may have adverse influence on metal removal during biological waste water treatment in some European areas. Where high population density and intense industrial activity occur together, large quantities of detergent builder in domestic waste water and significant concentrations of heavy metals from industrial and domestic sources may be combined. Water reuse may also be practiced. Under such conditions, nitrilotriacetric acid may diminish metal removal in waste water treatment. Most scientific literature on this subject is from Canada, where the low nitrilotriacetic acid con-centrations in effluent may be attributable to great dilutions by the abundant receiving waters. Laboratory simulations of conditions in European population centers can be resolved by research which is now in progress using pilot scale equipment treat-ing real sewage. (Titus-FRC) W81-01147

EFFECT OF ALCOHOLS ON THE MECHANI-CAL AND TRANSPORT PROPERTIES OF ASYMMETRIC CELLULOSE ACETATE MEM-BRANES,

Naples Univ. (Italy). Ist. di Principi di Ingegneria

Chimica. F. Alfani, E. Drioli, and L. Nicolais. Water Research, Vol 14, No 5, p 461-466, May, 1980. 7 Fig, 2 Tab, 11 Ref.

Descriptors: *Membrane processes, *Alcohols, Membranes, Separation techniques, Organic compounds, Mass transfer, Reverse osmosis, Treatent, *Waste water treatment, Strength of materials. Tensile strength.

One problem in the use of reverse osmosis (RO) aste water treatment is the choice of a proper membrane, since the interaction with organic commembrane, since the interaction with organic compounds and therefore membrane selectivity is strongly dependent on membrane structure. The interaction between solute and membrane was analyzed in the presence of various alcohol solutions using a combined analysis of tensile properties and rejection performance of different RO membranes. The findings indicate that commercial cellulose acctate membranes may be used in ultrafiltration processes to recover alcohols from the water. The nallysis of stress-strain curves of virgin membranes. analysis of stress-strain curves of virgin membranes conditioned in alcohol solution can assess the po-tentiality of the cellulose acetate membrane in the alcohol recovery process. (Baker-FRC)

A CORRELATION METHOD FOR THE ESTI-MATION OF RETENTION TIMES AT FULL-SCALE SEWAGE TREATMENT PLANTS,

University of Strathclyde, Glasgow (Scotland). Dept. of Applied Physics. J. M. Crowther, J. F. Dalrymple, and T.

Water Research, Vol 14, No 6, p 567-574, June, 1980. 6 Fig, 3 Tab, 16 Ref.

Descriptors: *Retention, *Sewage treatment, *Biochemical oxygen demand, *Suspended solids, *Correlation analysis, Indicators, Tracking techriques, Theoretical analysis, Flow rate, Variability, Statistical methods, Water analysis, Dye releases, Path of pollutants, Hydraulics, Settling basins, Sediments, Evaluation.

An alternative method for measuring retention time is described. Estimates of retention time are derived by applying correlation analysis to flow rates. The method yields an average retention time, and thus provides information on the average hydraulic performance of the unit. Diurnal and random variations in influent biochemical oxygen demand and suspended solids are used as time-varying tracers. Three time series experiements were conducted using biochemical oxygen demand results taken from samples at varying flow rates. Correlation analysis was performed, uncertainties in periods and retention times were calculated, and influent and primary tank biochemical oxygen de-mands were cross-correlated. Results show no clear dependence on flow rates. Discrepancies in results between correlation estimates and flowbased estimates suggest that approximately 50% of the sedimentation tank volume is not exploited by flow and represents a dead volume. (Titus-FRC) W81-01150

EXPERIMENTAL ASSESSMENT OF HALO-FORM REACTION PRECURSORS (ETUDE D'UNE METHODE D'EVALUATION GLO-BALE DES PRECURSEURS DE LA REACTION HALOFORME),

Potiters Univ. (France). Lab. de Chimie XI. M. Dore, and J. Goichon. Water Research, Vol 14, No 6, p 657-663, June, 1980. 6 Fig. 1 Tab, 11 Ref.

Descriptors: *Chlorination, *Water purification, *Spectrophotometry, *Chemical analysis, Iodine, Halogens, Chemical reactions, Chlorine, Analytical techniques, Ammonia, Haloforms, Haloform precursors.

A method for evaluating haloform reaction precur-A method for evaluating individual reaction precursors is explained. The principle of the analysis is based on the action of iodine on the precursors and on the measurement of the amount of iodoform obtained by spectrophotometry in the utra-violet band. The reaction parameters (conditions of pH and of extraction, time of reaction) were studied to produce a simple analytical method of operating, presenting both precision and sensitivity. Iodine constitutes an interesting reagent for this measurement because it is not consumed by ammonia and it displays four characteristic bands in the ultra-violet range. The reaction gives good results with ket noic precursors; however, weth metapolyhydroxybenzenes, results are inferior to those obtained by chlorination. (Titus-FRC) W81-01151

LOS ANGELES TO MEET REGS WITH ENERGY-MISER SLUDGE PROCESSOR,

D. C. Tillman. Water and Sewage Works, Vol 127, No 11, p 30-32, 62, November, 1980. 3 Fig.

Descriptors: *Sludge disposal, *Los Angeles, *Hyperion plant, *Sludge treatment, *Ultimate disposal, Municipal wastes, Waste water treatment, Waste disposal, Thermal sludge disposal, Electric power production

To comply with directives prohibiting disposal of sewage sludge in Santa Monica Bay, the city of Los Angeles chose a sludge treatment method which produces energy from gases formed during digestion. The Hyperion Plant, which will be fully operational by 1985, will be capable of processing 264 tons per day (dry basis) using the thermal sludge disposal system. The process not only provides energy for evaporation of sludge water and for thermal destruction of solids by pyrolysis, it produces a surplus of 200,000 kilowatt hours of electricity per day. The thermal disposal system has several advantages over conventional sludge disposal systems: low energy requirements, greatly disposal systems: low energy requirements, greatly reduced amount of solids handled, an essentially sterile sludge, 99+% solids removal, and an effluent closely approaching distilled water. (Cassar-W81-01152

PACKED BED FILTRATION: EXPERIMENTAL INVESTIGATION AND CONCEPTUAL ANALYSIS OF FILTER RIPENING MODEL, North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161 as PB81-151961. Price codes: A07 in paper copy, A01 in microfiche. MS Thesis, 1979. 136 p, 30 Fig. OWRT-A-104-NC(1), 14-34-0001-9035.

Descriptors: Filtering systems, Packed beds, *Water treatment, *Filters, *Waste water treat-ment, Filtration, *Separation techniques, Evalua-tion, Packed beds, Suspended solids, Particle size, Liquid-solids separation, Filter ripening model.

A theory for filter ripening (Ali, 1977) is subjected A theory for filter ripening (All, 1977) is subjected to experimental and conceptual analysis in order to test its applicability under conditions much different than those for which it was calibrated and verified. The filtration theory incorporates physical and chemical characteristics of the entire filtraton system in predicting the removal of suspended solids and the development of head loss throughout a filter run. Filtration performance is a function of filter variables (bed depth, porosity, filtration velocity, media size and type) and suspension variables (solids concentration, temperature, particle size and type). The chemistry of the system (ionic strength, polymer type and dose) also controls filter performance and is included in the theory. filter performance and is included in the theory. Experiements are conducted by filtering suspensions of Min-U-Sil particles at two different size ranges at two concentrations and flow rates through pilot filters. Four identical filter columns, each containing different sized media, are used in each experiment. Solids removal efficiency is evaluated by measuring the light scattering of influent and effluent samples. Head loss is determined from open manometers connected to the filter columns. open manometers connected to the filter columns The experimental results are compared to predic-The experimental results are compared to predictions obtained from the theory for filter ripening. In general, the effects of variations in collector size, suspended solids concentration, flow rate and particle size on filter performance are modeled correctly, but exact fits using consistent values for model coefficients are not obtained. Removal efficiency is modeled well but head loss predictions are not generally in agreement with the experimen-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Water Treatment and Quality Alteration—Group 5F

tal results. Conceptual considerations yield possible explanations for these discrepancies. W81-01168

TREATMENT OF DILUTE METAL EF-FLUENTS IN AN ELECTROLYTIC PRECIPI-TATOR

University of the Witwatersrand, Johannesburg Gouth Africa). Dept. of Chemical Engineering. A. W. Bryson, and K. A. Dardis. Water SA, Vol 6, No 2, p 85-87, April, 1980. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Industrial wastes, *Metals, *Effluents, *Waste water treatment, *Electroplating, Electrodes, Nickel, Chromium, Copper, Zinc.

The presence of metals in industrial effluents may cause problems during sewage treatment processes which use bacterial action to digest sludge. A test which use bacterial action to digest sludge. A test plant was constructed to remove these metals from dilute solutions by electrolytic precipitation using a particulate bed electrode cell. A fixed-bed cell (1900 mm x 350 mm x 5 mm) containing crushed graphite of a particle size of 1.2 mm to 1.7 mm was able to reduce the concentrations of nickel, chroable to reduce the concentrations of mickel, crito-mium, copper, and zinc in electroplating works effluent water from 16.2-37.5 mg per liter to 1.5 mg per liter or less. Current ranged from 20 to 40 amperes; voltage ranged from 3.0 to 5.4 volts; and the flow rate was 180 liters per hour for nickel and chromium and 360 liters per hour for copper and zinc. (Cassar-FRC) W81-01172

5E. Ultimate Disposal Of Wastes

CHEMICAL DOSAGE CONTROL FOR PHOS-PHORUS REMOVAL.

Pollutech Pollution Advisory Services Ltd., Oakville (Ontario) For primary bibliographic entry see Field 5D. W81-01018

LONG TERM EFFECT OF SEWAGE SLUDGE ADDITIONS ON POPULATIONS OF NOCAR-DIA ASTEROIDES, MICROMONOSPORA AND THERMOACTINOMYCES IN SOIL,

Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau. bibliographic entry see Field 5C. For primary W81-01061

SEWAGE: WASTE OR RESOURCE,

Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5D.
W81-01064

APPLICATION OF SEWAGE EFFLUENT TO COLUMNS OF A MOUNTAIN MEADOW SOIL: I. ERRORS IN CALCULATING THE TRANSPORT OF IONIC SALTS,

Colorado State Univ., Fort Collins. Dept. of

Agronomy.
For primary bibliographic entry see Field 3C.
W81-01090

METAL UPTAKE BY CROPS GROWN OVER ENTRENCHED SEWAGE SLUDGE, Science and Education Administration, Beltsville, MD. Biological Waste Management and Organic Resources Lab.

L. J. Sikora, R. L. Chaney, N. H. Frankos, and C.

M. Murray. Journal of Agricultural and Food Chemistry, Vol 28, No 6, p 1281-1285, November/December, 1980. 4 Tab, 22 Ref.

Descriptors: *Sludge disposal, *Crop response, *Metals, *Waste disposal, *Sewage sludge, Municipal wastes, Lime, Disposal, Oats, Wheat, Chard, Entrenchment, Ultimate disposal, Waste water treatment, Landfills, Agriculture.

Oats, wheat, and chard were grown on plots containing entrenched sewage sludge from the Blue

Plains waste water treatment plant, Washington, D.C. Two forms of sludge were used, digested and raw limed, in a study of metal uptake by crops. Lime was applied to half the digested and half the control plots to determine the influence of pH on metal uptake. Chard accumulated higher metal levels than either wheat or oats. Absorption of pure the plants grown over sludge was greaters. levels than either wheat or oats. Absorption of metals by plants grown over sludge was greatest using unlimed digested sewage (pH 5.4). Liming these plots reduced metal uptake slightly. Plants absorbed metals from limed raw sludge plots (pH 6.7) to an equal or lesser degree than in control plots. These results suggested that agricultural crops may be grown over entrenched sludges (raw or digested) if the sludge is low in heavy metal content (Cassar-FEC) content. (Cassar-FRC) W81-01100

5F. Water Treatment and **Quality Alteration**

ELECTRON MICROSCOPY OF GIARDIA

LAMBLIA CYSTS, Washington Univ., Seattle, Dept. of Environmental Health.

D. L. Luchtel, W. P. Lawrence, and F. B. DeWalle.

Applied and Environmental Microbiology, Vol 40, No 4, p 821-832, October, 1980. 19 Fig, 23 Ref.

Descriptors: *Protozoa, *Water purification, *Fil-Descriptors: Protozoa, water purincation, Pri-ters, Public health, Filtration, Potable water, Water pollution, Electron microscopy, Separation techniques, Coagulation, Water pollution treat-ment, Human diseases, Pilot plants, Membranes.

Current outbreaks of giardiasis have been associated with exposure to Giardia lamblia in municipalities that use inadequately-treated surface water for drinking water. Methods of coagulation and dual media filtration to treat water to remove the G. media filtration to treat water to remove the G. lamblia cysts were investigated in pilot plant stud-ies. Electron microscopic studies of cysts collected on 5.0 micrometerporosity membrane filters were also conducted. G. lamblia cysts isolated from fecal samples from human giardiasis patients and other fecal material were diluted in distilled water to known concentrations, and the dilutions were used to spike pilot plant water supplies. In addition to the 5.0 micrometer Nuclepore membrane, Millipore filters of 5.0 micrometer-pore size were evaluated to increase filtration efficiency. Results showed a greater percent recovery on the Nuclepore filter as opposed to the Millipore filters. Electer of the property of the Nuclepore filter as opposed to the Millipore filters. tron microscopic studies of cyst walls showed dif-ferent patterns of distortion between G. lamblia cysts collected on Nuclepore and on Millipore filters. The implications of cyst distortion on filters for the purification of raw water samples are discussed. (Geiger-FRC) W81-01059

LOW-COST FILTER SYSTEM MEETS DRINK-ING WATER STANDARDS, CH2M/Hill, Redding CA. R. L. Chapman, and G. R. Benoit. Public Works, Vol 111, No 9, p 102-104, Septem-ber 1990 1 Fig. 2 Teb. ber, 1980. 1 Fig, 2 Tab.

Descriptors: Turbidity, *Filtration, *Water treatment, *Sacramento River, *Bella Vista Water District(CA), Water quality, Rivers, Pilot plants, Alum, Costs, Annual costs, Capital costs, *Potable water, Standards.

Increasing domestic and irrigation water demand in the Bella Vista Water District, Redding, Califor-nia, approached the capacity of well sources and ma, approached the capacity of well sources and required the use of Sacramento River water with objectionable turbidity above 1.0 at minimal added cost. In 1976 pilot plant studies were begun on a low-cost, direct high pressure filtration system. The major objective was to determine the filterabi-lity of the Sacramento River water under different turbidity conditions. Construction of the full-scale treatment plant was completed in summer 1978 at a total cost of 6.47 million dollars. Two years operation of this system has proved that the fundamental design is good and that operation and maintenance costs are low. During 1979, 3,428 million

gallons of water were treated at a cost of \$9.77 per gallons of water were treated at a cost of \$9.77 per million gallons. Filtered water turbidities averaged less than 0.5 unit, and raw water turbidities ranged from 15 in winter to 1.9 in summer. Studies at higher filtration rates indicated that 6.5 million gallons per day (turbidity 0.2 - 0.4 unit) was pro-duced at the end of a 10 hour test from raw water with 9.5 turbidity. (Cassar-FRC) W81-01084

CORROSIVENESS OF DRINKING WATER AND CARDIOVASCULAR DISEASE MORTAL-

Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).

B. J. A. Haring, and B. C. J. Zoeteman.

Bulletin of Environmental Contamination and Toxicology, Vol 25, No 4, p 658-662, October, 1980. 4 Tab, 10 Ref.

Descriptors: *Hardness(Water), *Human diseases, *Potable water, Hydrogen ion concentration, Epidemiology, Mortality, The Netherlands.

Many epidemiologists have reported that hard water is statistically correlated with low death rate from cardiovascular diseases. A sampling program was carried out in The Netherlands among 28 water supplies to measure pH and water hardness of the drinking water. The pH values were deter-mined, since higher pH values are generally associ-ated with lower metal solvency. A significant neg-ative correlation was found between hardness and aure correlation was found oetween nariness and pH for the water supplies tested. A possible explanation for these results is that at present most waterworks condition the water in such a way that drinking water is saturated with respect to CaCO3. Also, the saturation pH of hard drinking water is usually lower than that of soft water. The intake of Issually lower than that of soft water. The make of lead and other inorganic constituents was investigated in a proportional sampling study of 50 households with lead piping in each of 20 cities in the Netherlands. The release of lead and copper from metal household water distribution pipes was posi-tively correlated with calcium content. The softer water had higher pH values and lower levels of lead and other metals, in general. (Small-FRC) W81-01109

COLOUR AND TURBIDITY REMOVAL WITH REUSABLE MAGNETIC PARTICLES-II. CO-AGULATION WITH MAGNETIC POLYMER COMPOSITES,

Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.

N. J. Anderson, B. A. Bolto, R. J. Eldridge, L. O. Kolarik, and E. A. Swinton.
Water Research, Vol 14, No 8, p 967-973, August, 1980. 2 Fig. 10 Tab, 4 Ref.

Descriptors: *Color, *Turbidity, *Flocculation, Descriptors: Color, Turoliny, Proceduator, *Iron oxides, Separation techniques, Settling ve-locity, Polymers, Resins, Aquatic algae, Water treatment, Water purification, Surface water, Cation exchange, Magnetism.

The coagulation of a turbid, colored river water was enhanced by composite particles containing magnetic iron oxides in polyvinyl alcohol matrix. The removal of turbidity at a given alum dose was increased by uncharged magnetic particles. Desired levels of turbidity were removed at lower doses of alum. When alum plus magnetic iron oxides were used, the rates of floc formation and settling were doubled. The effectiveness of coagulation was increased by grafting linear polymers to magnetic polymers, and the uncharged particles could be reused after rinsing with water. When alum was used with magnetic particles which were grafted with chains of cationic polymers, rapid settling, coagulation of algae, and removal of color and turbidity were achieved. Regeneration of prafted particles was accomplished by addition of brine. Although incomplete regeneration occurred when the cationic magnetic particles were used without alum, good turbidity and color removal from river water were obtained. (Geiger-FRC) W81-01141 The coagulation of a turbid, colored river water

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F-Water Treatment and Quality Alteration

CHLORINE DISAPPEARANCE IN SEA WATER.

Central Electricity Generating Board, Leather-head (England). Central Electricity Research Research

Water Research, Vol 14, No 10, p 1559-1560, October, 1980.

Descriptors: *Chlorine, *Bromine, Chemical reactions, *Water chemistry, *Sea water, *Cooling water, Salinity, Ionization, Acid-base equilibrium, Solubility, Chemistry, Catalysts, Water properties, ater, Power system operation.

An explanation for chlorine disappearance in sea water is proposed. The oxidation of bromide in seawater produces hypobromite and hypochlorite. In such mixtures, chlorate formation is catalyzed by hypobromous acid. Experiments at carefully by hypobromous acid. Experiments at carefully controlled pH are needed to confirm the explanation and estimated decay rate. Digestion with concentrated hydrochloric acid under inert atmosphere is recommended for future experimentation. The practical importance of chlorine disappearance in power station cooling waters is questioned. (Titus-FRC) W81-01143

WASTEWATER CHARACTERIZATION IN A MULTIPRODUCT DAIRY,

North Carolina State Univ., at Raleigh R. E. Carawan, V. A. Jones, and A. P. Hansen. Journal of Dairy Science, Vol 62, No 8, p 1243-1251, August, 1979. 3 Fig, 5 Tab, 12 Ref. OWRT-A-058-NC(3), 14-31-0001-3533.

Descriptors: *Water pollution sources, *Dairy industry, *Industrial wastes, Water quality, Industrial effluents, Waste water characterization, Surcharges, Water costs, *Industrial water, Sewers.

Wastewater characteristics in a multi-product dairy plant were determined in two major drains and for several operations. Monitored characteris-tics included flow, biochemical oxygen demand, tics included flow, biochemical oxygen demand, chemical oxygen demand, total suspended solids, total solids, fat, and temperature. Overall, 2.3 liters of wastewater/kg of product were discharged with average concentrations of 3049 mg/liter biochemical oxygen demand, 5451 mg/liter chemical oxygen demand, 2203 mg/liter total suspended solids, 9574 mg/liter total suspended solids, 9574 mg/liter total solids, and 1424 mg/liter fat. The biochemical oxygen demand coefficient was 6.91 g/kg of product. Day-to-day variations of waste load/unit product were large Peak day was 0.31 g/sg/of product were large. Peak day measures were more than 10 times as high as minimum day measures. Waste load discharged from the plant was related to losses of milk and fat. from the plant was related to losses of milk and fat. Losses of milk and milk fat calculated from waste characteristics were greater than indicated by plant records. Municipal charges for water, sewer, and surcharges for a plant processing 200,000 kg of product per day with the average characteristics in this study were predicted to be approximately \$18,600 per month. Waste loads for selected operations are presented with suggestions for reduction. tion W81-01170

5G. Water Quality Control

A ONE-DIMENSIONAL, STEADY-STATE, DIS-SOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR LITTLE LAUGHERY CREEK, RIPLEY AND FRANK-LIN COUNTIES, INDIANA,

Geological Survey, Indianapolis, IN. Water Re-

For primary bibliographic entry see Field 5B. W81-01025

VIRUSES IN GROUNDWATER, Baylor Coll. of Medicine, Houston, TX. oliographic entry see Field 5B. For primary W81-01121

AN AUTOMATED SYSTEM FOR MONITOR-ING THE KINETICS OF BIOLOGICAL OXIDA-

TION OF AMMONIA,
Consiglio Nazionale delle Ricerche, Rome (Italy).
Inst. for Water Research.
For primary bibliographic entry see Field 5B.
W81-01135

EFFICIENT DESIGN OF STORMWATER HOLDING BASINS USED FOR WATER QUALITY PROTECTION,

North Dakota State Univ., Fargo. Dept. of Civil

Engineering.
D. M. Griffin, Jr., C. Randall, and T. J. Grizzard.
Water Research, Vol 14, No 10, p 1549-1554, October, 1980. 6 Fig, 2 Tab, 6 Ref.

Descriptors: *Runoff, *Urban runoff, *Storm drains, On-site data collections, Rainfall-runoff relationships, Small watersheds, Design data, Design criteria, *Water pollution control, Suspended solids, Field data, Settling basins, Unit hydrographs, Water pollution sources, Surface runoff, Storm water.

A rational method for the design of stormwater basins is proposed, and a design example is presented. The method is based on the retention of a predetermined fraction of the pollution load leaving a catchment. Holding basin dimensions can be determined given a known runoff volume required to trap a desired mass of pollutants. The parameters are calculated from data which includes a design storm event, the relationship between total runoff volume and total pollutant load, and a loading curve. Though this data is not yet commonly ing curve. Though this data is not yet commonly available it may be possible to generalize loading curves for various types of land use with additional research. It is anticipated that the proposed design method could result in smaller holding basins than if designs were based on runoff volume. (Titus-W81-01136

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

PLANNING AND DESIGN OF STUDIES FOR RIVER-QUALITY ASSESSMENT IN THE TRUCKEE AND CARSON RIVER BASINS, CALIFORNIA AND NEVADA, Geological Survey, Carson City, NV. Water Re-

sources Div. J. O. Nowlin, W. M. Brown, III, L. H. Smith, and R. J. Hoffman.

R. J. Hoffman.
Available from the OFSS, USGS Box 25425, Fed.
Ctr., Denver, CO 80225, Price: \$10.50 in paper copy, \$3.50 in microfiche. Geological Survey Open-File Report 80-435, June, 1980. 75 p, 11 Fig, 14 Tab, 46 Ref.

Descriptors: Evaluation, *Water quality, *River basins, Planning, *Water resources development, Assessments, Water pollution sources, Aquatic environment, Management, Methodology, Mathematical models, Simulation analysis, Land use, California, Nevada, *Truckee River basin(CA-NV), *Carson River basin(CA-NV).

The objectives of the Geological Survey's river-quality assessment in the Truckee and Carson River basins in California and Nevada are to identito develop techniques to assess the problems; and to effectively communicate results to responsible to effectively communicate results to responsible managers. Six major elements of the assessment to be completed by October 1981 are (1) a detailing of the legal, institutional, and structural development of water resources in the basins and the current problems and conflicts; (2) a compilation and synthesis of the physical hydrology of the basins; (3) development of a special workshop approach to involve local management in the direction and results of the study; (4) development of a comprehensive streamflow model emcompassing both basins to provide a quantitative hydrologic both basins to provide a quantitative hydrologic framework for water-quality analysis; (5) develop-

ment of a water-quality transport model for selected constituents and characteristics on selected reaches of the Truckee River; and (6) a detailed examination of selected fish habitats for specified reaches of the Truckee River. Progress will be periodically reported in reports, maps, computer data files, mathematical models, a bibliography, and public presentations. In building a basic framework to develop techniques, the basins were viewed as a single hydrologic unit because of interconnecting diversion structures. The framework comprises 13 hydrographic subunits to facilitate modeling and sampling. Several significant issues beyond the scope of the assessment were considered as supplementary proposals; waterissues beyond the scope of the assessment were considered as supplementary proposals; water-quality loadings in Truckee and Carson Rivers, urban runoff in Reno and management alternatives, and a model of limnological processes in Lahontan Reservoir. (USGS) W81-01024

MODEL EVALUATION OF THE HYDROGEO-LOGY OF THE MORRIS BRIDGE WELL FIELD AND VICINITY IN WEST-CENTRAL

FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.

P. D. Ryder, D. M. Johnson, and J. M. Gerhart. Geological Survey Water-Resources Investigations 80-29, 1980. 92 p, 35 Fig, 2 Tab, 28 Ref.

Descriptors: *Model studies, *Hydrogeology, *Po-tentiometric level, *Simulation analysis, *Florida, Water wells, Aquifer characteristics, Groundwater movement, Water supply, Groundwater resources, Pumping, *Floridan aquifer, *Morris Bridge well field, West-central Florida.

The Morris Bridge well field in west-central Florida, which is being developed may have a maximum well-field withdrawal of 40 million gallons per day. The water will be pumped from the Floridan aquifer--a sequence of carbonate rocks about 1,100 feet thick underlying surficial sand and clay deposits. A highly fractured and transmissive zone about 500 feet below National Geodetic Vertical Datum of 1929 will supply a large proportion of the water. Two-dimensional and three-dimensional digital flow models were used to evaluate sional digital flow models were used to evaluate the hydrogeology of the area. The model-derived leakance distribution (a property of the confining bed) for a 285-square-mile area ranged from 0.00002 to 0.008 per day. Model-derived transmissivity values for the Floridan aquifer ranged from 37,000 to 600,000 feet squared per day. Model-derived specific yield values for the surficial aquifer ranged from 0.05 to 0.30. The three-dimensional model was used to predict drawdowns in both the Floridan and surficial aquifers in response to a 40 million gallon per day stress. Mass-balance ooth the Fiorition and surricial adulters in response to a 40 million gallon per day stress. Mass-balance data from a 30-day simulation with no recharge from rainfall show percentage of withdrawn water that is derived from: (1) aquifer storage, (2) the Hillsborough River, and (3) reduction of evapotranspiration losses. (USGS) W81-01027

AN ECONOMIC ANALYSIS OF SELECTED STRATEGIES FOR DISSOLVED-OXYGEN MANAGEMENT; CHATTAHOOCHEE RIVER,

Geological Survey, Reston, VA. Water Resources

For primary bibliographic entry see Field 5B. W81-01036

CONSERVATION V. LAND DRAINAGE - A GUIDE FOR THE FUTURE,

Water Space Amenity Commission, London (Eng-

S. Lucas Water, No 34, p 7-10, September, 1980.

Descriptors: *Controlled drainage, *Drainage programs, *Drainage effects, *Wildlife conservation, *Land management, Natural resources, Protection, Compensation, Comprehensive planning, Industries, Engineering, Water policy, Farm management, Governments, Watersheds, Adoption of practices, Grants, Planning, Projects.

Evaluation Process—Group 6B

The Water Space Amenity Commission's conservation and land drainage guidelines advise on how to minimize environmental damage related to land drainage schemes. They include three sections: adutamage scilentes. They include lines escentions: advisory notes, practice notes addressing specific environments, and appendices. The guidelines stress regional consultation and are intended for use by industry. Initiated in 1974, they were drafted by industry. Initiated in 1974, they were drafted by experts representing both conservation and drainage interests. The need for drainage and cost benefit analyses is not discussed. In a supplementary report issues such as compensation and areas where scientific research is needed are discussed, and case studies of controversial sites in England and Wales are presented. (Titus-FRC) W81-01048

DEVELOPMENT AND USE OF A MATH-EMATICAL MODEL OF THE SAN BERNAR-DINO VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Re-

For primary bibliographic entry see Field 2F. W81-01186 sources Div.

WATER-QUALITY INVESTIGATION OF THE CANEY CREEK WATERSHED, NORTHEAST ARKANSAS, Geological Survey, Little Rock, AR. Water Re-

Geological Survey, Little Rock, AR. Water Resources Div.
T. E. Lamb, and G. Newsom.
Available from the OFSS, USGS Box 25425, Fed.
Ctr., Denver, CO 80225, Price: \$2.25 in paper copp. \$3.50 in microfiche. Geological Survey Open-File Report 79-1064, 1979. 16 p, 1 Fig, 3

Descriptors: *Water quality, *Baseline studies, *Surface waters, *Groundwater resources, *Arkansas, Watershed management, Topography, Geology, Aquifers, Water analysis, Sampling, Chemical properties, Physical properties, Planning, Presoil conservation programs, *Caney Creek watershed(AR), *Northeast Arkansas.

The results of a 1-year study, in 1977-78, of sur-The results of a 1-year study, in 1977-78, of surface-water quality in the Caney Creek watershed, northeast Arkansas, are presented to document conditions before implementation of Soil Conservation Service programs. The report includes a general description of the watershed's topography, geology, and aquifers, and the results of several measurements at two sites of discharge, and a number of physical and chemical parameters. (USGS) (USGS) W81-01189

TEST MONITORING OF PROTOTYPE INJECTION WELL, WAIALE, MAUI, HAWAII,
Geological Survey, Honolulu, HI. Water Re-

sources Div R. L. Soroos

Geological Survey Open-File Report 79-274, January, 1979. 31 p, 7 Fig, 6 Tab, 5 Ref.

Descriptors: *Monitoring, *Injection wells, *Test-ing, *Hawaii, Pumping, Observation wells, Storm runoff, Groundwater, Water quality, Data collec-tions, Hydrographs, *Maui(HI), Baseline studies, Urban runoff, Water quality control.

A high-capacity prototype injection well was tested in the isthmus area of Maui, Hawaii. Pumping tests were made on April 14 and 15, 1978, and 10 injection tests were made between May 12 and June 30, 1978. Selected tests were monitored in order to obtain data which could be used to assess the effects of subsurface disposal on the ground water in the basal aquifer. Pumping and injection rates were measured. Basal-water head responses to pumping and injection were observed at the prototype well and at two observed in the prototype well and at two observation wells located 435 and 6,100 feet from the prototype well. Water-quality samples were collected at the prototype well and the nearest observation well prior to testing. Samples of the injection water, as well as samples from the observation wells, were collected prior to and after the final test. The head data and water-quality data are presented in this report.

QUALITY OF WATER IN THE BLACK RIVER NEAR DUNN, NORTH CAROLINA, AND GROUND-WATER LEVELS ADJACENT TO THE RIVER PRIOR TO CHANNEL EXCAVA-TION IN 1976-79, Geological Survey, Raleigh, NC. Water Resources

C. E. Simmons.

W81-01190

C. E. Simmons. Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: \$2.75 in paper copy, \$3.50 in microfiche. Geological Survey Open-File Report 80-425, 1980. 18 p, 4 Fig, 4 Tab, 1 Ref.

Descriptors: *Water quality, *Channel improvement, *Streams, *Water levels, *North Carolina, Small watersheds, Flow rates, Storm runoff, Streamflow, Sediment yield, Water temperature, Water analysis, Bacteria, Surface-groundwater relationships, Hydrologic data, *Black River(NC), Baseline studies, Effects, Dredging, *Flood control

During 1976-79 data were collected at three sites on the Black River, near Dunn, North Carolina, to define water-quality and other hydrologic conditions prior to channel excavation. Samples collected over a range in flow from 1.2 to 900 cubic feet per second contained 1 to 81 mg/L (milligrams per liter) of suspended sediment, 37 to 108 mg/L of dissolved solids, and 0.21 to 1.0 mg/L of total nitrogen. Water-level fluctuations in wells located within 100 feet of the Black River were almost identical with those of the stream. (USGS) identical with those of the stream. (USGS) W81-01193

6B. Evaluation Process

WATER RESOURCES RESEARCH COORDINATION AND PLANNING IN THE MISSOURI RIVER BASIN.

AVAilable from the National Technical Information Service, Springfield, VA 22161 as PB81-147803, Price codes: A03 in paper copy, A01 in microfiche. Missouri River Basin Region Water Resources Research Institutes Project Completion Report, March, 1978. 35 p. OWRT-B-038-NEB(1), 14-34-0001-7203.

Descriptors: *Water resources planning, *Regional analysis, Water problems, *Groundwater resources, *Groundwater allocation(Policy), *Missouri River basin, Project planning, Financial feasi-

The main objectives in this project were to: (1) identify and categorize water problems; (2) develop alternatives and regional research proposals for finding their solutions; (3) develop financial plans for research within the region; and (4) provide a means of communication between the institutes for the exchange of ideas on water resources research in the basin. The Missouri River Basin Water Institute Consortium (MRBWIC) selected a particular problem to receive most of its attention. This was the problem of the allocation of the diminishing groundwater supplies in the Basin. MRBWIC worked closely with the Missouri River Basin worked closely with the Missouri River Basin Commission in conducting a workshop of groundwater allocation and publishing the proceedings. Research needs to make sound decisions on water allocations were developed and the cost of this research estimated.

WASTEWATER TREATMENT EVALUATED BY FORCE ACCOUNT, PROCESS

Montana State Univ., Bozeman. R. L. Sanks, J. W. Tacke, and J. E. Connell. Public Works, Vol 111, No 11, p 82-84, November,

Descriptors: *Waste water treatment, *Sewage treatment, *Municipal wastes, *Cost-benefit analysis, Pilot plants, Force account, Rotating biological contactor, Filtration, Livingston(MT), Yellow-

The city of Livingston, Montana, population 8,000, used the force account approach to evaluate a rotating biological contactor which had been prorotating biological contactor which had been proposed as part of a \$3.5 million treatment plant expansion. A full-sized rotating contactor was too costly to test. Therefore, 48 four foot diameter discs were tested. Construction of the pilot plant was largely done by city employees. Most of the operation was done by a university student. Although analyses were originally planned to be done by city employees, most procedures were eventually contracted to the university. The pilot plant program, which cost less than \$24,000, showed that the surface area of the units should be increased by 10%. Plant operators and city personnel, having been involved with the testing program, readily accepted the new system and accumulated considerable experience for operation of the full-scale plant. (Cassar-FRC) W81-01086

AN ECONOMIC EVALUATION OF THE FEAS-IBILITY OF ARTIFICIAL GROUNDWATER RECHARGE IN NEBRASKA,
Nebraska Univ.-Lincoln. Dept. of Agricultural

Economics.
R. J. Supalla.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB81-148066,
Price codes: A03 in paper copy, A01 in microfiche.
Nebraska Water Resources Center, University of
Nebraska, Project Completion Report, January,
1981. 30 p. OWRT-A-065-NEB(1), 14-34-0001-

Descriptors: *Artificial recharge, *Groundwater recharge, Economics, Groundwater management, *Irrigation water, *Economic feasibility, *Nebras-ka, Cost-benefit analysis, Evaluation.

ka, Cost-benefit analysis, Evaluation.

The purpose of this project was to analyze the economic feasibility of recharge for irrigation use. This involved developing a procedure for estimating recharge benefits, application of the benefit estimating procedure to a proposed Nebraska case, and a review of the literature regarding recharge program costs. The benefit estimating procedure considers two types of benefits: those due to reduced pumping lifts and those due to extended aquifer life. Procedures regarding a minimum amount of data were specified for each of these components. It was found that recharge benefits in irrigation use areas could range from less than \$2\$ to nearly \$20 an acre-foot, with the most likely value being in the \$15\$ to \$10 range. This range of values reflects different assumptions regarding lift effects, energy prices, farm commodity prices and discount rates. When estimated benefits were compared to available published data on recharge costs, it was found that single-purpose recharge projects to augment water supplies for irrigation would be economically infeasible in most cases. If artificial recharge is to be a viable option, it must be pursued as part of a multi-purpose water development project. be pursued as part of a multi-purpose water development project.

DESIGN OF OBJECTIVE FUNCTIONS FOR RESERVOIR OPERATIONS

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. T. Westgate.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150229, Price codes: A05 in paper copy. A01 in microfiche. MS Thesis, Fall, 1980. 74 p. 42 Ref. OWRT-B-195-COLO(3)

Descriptors: "Reservoirs, Objective functions, "Reservoir operation, Objective change, "Multi-ple-purpose reservoirs, Reviews, Evaluation, "Optimum development plans.

This research investigates the objective function as a potential weak link in the application of the tools of water resources research to the problems of reservoir operations. Reservoir systems are contin-ually evolving due to changes in the systems' pur-poses, capabilities, or hydrology. In response to these changes, Reservoir Operations is called upon to evaluate alternative operations policies for their

Field 6—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

performance on system objectives. Reservoirs often have multiple purposes, and these purposes have multiple performance measures. A catalog of performance measures found in the water resources literature is presented along with a methodologie for solucing the approximation of the performance measures. odology for selecting the performance measures to be used for the objective function of the analysis. W81-01169

AGRICULTURE AND HYDRO-F COSTS, BENEFITS, AND TRADE-OFFS, HYDRO-POWER: Oregon State Univ., Corvallis. Dept. of Agricultural and Resource Economics.

W. Obermiller.

F. W. Obermiller.

In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80. July, 1980, p 57-64. 2 Fig. 8 Ref.

Descriptors: *Columbia River. *Hydroelectric power, *Cost-benefit analysis, *Irrigation programs, *Cost comparisons, Unit costs, Income analysis, Cost sharing, Input-output analysis, Energy loss, Income, Return flow, Diversion losses, Agriculture.

It has been predicted that within four to five years. the Columbia River's system-wide water supplies will be fully utilized. Tradeoffs must be considered. One involves the benefits resulting from increases in irrigated agriculture versus the opportunities foregone because of outstream diversion of system waters. There are primary (direct), secondsystem waters. There are primary (unterly, second-ary (indirect), and public benefits and costs as a result of irrigation development. Using price, cost, crop, and acreage projections, the net primary benefits of future irrigation development can be derived. Future primary benefits 'with irrigation' might be \$43 million per year, or \$220/acre-year. Correcting for higher energy pumping and other costs, the net benefits could be \$32/acre-year. The net secondary benefits would increase local non-agricultural household income to the equivalent of \$237/acre-year. The net social benefits, the sum of the primary and secondary benefits, should exceed \$270/acre-year. However, the value of lost hydroelectric generating capacity must be considered. The calculations given derive an 'opportunity cost' figure of \$37.80/acre to replace foregone electric power. Viewed purely from an efficiency standpoint, the Columbia River water has a higher value in irrigation than in hydroelectric power genera-tion. From an equity perspective the verdict is less clear, since the cost of replacing the lost electric power would be borne mostly by people who would not benefit directly from the irrigation. However, if local beneficiaries were to compensate non-local users of electricity, the tradeoff would be both efficient and fair. (Atkins-Omniplan) W81-01199

NAVIGATION AS AN ALTERNATIVE USE,

Oregon State Univ., Corvallis. Dept. of Agricul-tural and Resource Economics. M. V. Martin.

In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80. July, 1980, p 89-107. 1 Fig. 7 Tab.

Descriptors: *Columbia River, *Cost-benefit anal-ysis, *Transportation, *Navigation, Water re-sources development, Income distribution, Social impact, Economics, Commercial fishing, Barges,

Navigational use of the Columbia River's water resources makes a variety of contributions to the economy of the Pacific Northwest. Recent navigation improvements have increased transportation activity on the river. The benefits from commercial navigation arise from on-river downstream movements, capacity availability and developmental influences. On-river barge transportation directly benefits, chairing for the property of the benefits shippers (producers) and ultimately con-sumers. Low barge rates reduce the delivered price of commodities shipped to upriver areas. Likewise, intermodal competition depresses rail rates. A high-capacity barge system lessens the possibility of a peak period shortage of transportapossibility of a peak period shortage of transporta-tion. Output, employment and income multipliers illustrate how navigation stimulates the economy. There are direct and indirect costs of commercial navigation. Direct costs include construction, maintenance and operation of navigational aids. Indirect costs include foregone energy generation, water loss for irrigation, road damage and damage to the river ecology. Often the direct beneficiaries do not bear the incidence of the associated costs. However, it can be argued that society is served from such subsidies. Tradeoffs to allocate the river's resources have to be made and commercial navigation must be considered along with other uses. (Atkins-Omniplan) W81-01202

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WHOLESALE WATER PRICING: A COST-TO-SERVE PLAN THAT WORKS,

K. Grover. American City and County, Vol 95, No 11, p 65-67, November, 1980.

Descriptors: *Cost allocation, *Water rates, Economics, *Pricing, Cost sharing, Water policy, Cost analysis.

A new financing system put into effect by the Portland, Oregon, Water Bureau has allowed the Bureau to create the revenues it needed to accomplish capital improvement programs and ensure future water stability to the area it serves. The system uses a utility enterprise basis for determining a utility's revenue requirements, a capacity-commodity rate based on cost-to-serve figures, a separate customer service charge, a guaranteed separate customer service charge, a guaranteeu sale of water to all purveyors, a system wherein financing responsibility for new facilities designed to benefit a purveyor or purveyors is assumed by the purveyor(s), and a growth impact charge. Reg-ular monthly meetings are held to avoid any lack of communication problems between the Water on communication problems between the Water Managers' Advisory Board and the Bureau. In place of 10 yr purveyor contracts, Portland has secured 25 yr contracts with all except one of its 42 purveyors. (Baker-FRC) W81-01104

INTERNATIONAL MANAGEMENT OF THE

COLUMBIA, Oregon State Univ., Corvallis. Dept. of Geogra-For primary bibliographic entry see Field 6E. W81-01201

6D. Water Demand

WATER USAGE PATTERNS IN THE U.S. VIRGIN ISLANDS, Caribbean Research Inst., St. Thomas (Virgin Is-

Caribbean Research Inst., St. I homas (Virgin Islands). Water Resources Research Center.
D. C. Bullock, R. W. Peebles, and H. H. Smith.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB81-147829.
Price codes: A03 in paper copy, A01 in microfiche.
Completion Report, August, 1980. 26 p. 24 Tab. (D. Ref., 1 Append. OWRT-A-011-VI(1), 14-34-0001-

Descriptors: *Water utilization, *Virgin Islands, *Water distribution(Applied), *Consumptive use, *Water management(Applied), Use rates, Geographical graphical regions, Islands, Regions, Precipitation(Atmospheric), Water sources, Use of r. Potable water, Recreation, Water conserva-Water demand, Water rates, Water resources, Planning, Estimating.

This study was conducted to develop an original data set on the water use pattern for dwelling units occupied by residents and tourists, and to analyze the data to provide per capita demand figures for residential water use in light of increasing water supply costs. Thirteen dwelling units were selected

and monitored by the installation of a novel clock-pressure switch water measurement system for a pressure switch water measurement system for a monitoring project that covered 1790 dwelling unit days involving 5900 people days, from November 1979 to July 1980. Major user categories included tourists, residents of island origin, and resident continentals. All but one site were owner operated and none of the units depended on piped/desalted water. Over 90% of the water used was supplied by rainfall. The major conclusion of the study was that high standards of living can be maintained in the U.S. Virgin Islands with an average domestic water usage of less than 40 and perhaps as low as water usage of less than 40 and perhaps as low as 30 gallons per person per day. Residential water usage can be cut at least in half if the occupants have sufficient economic incentives to conserve water. Residents of island origin are more conservative than residents of continental origin if sufficient expenses of continental origin in sufficient expenses or continental origin in sufficient expenses oreconsists or continental origin in sufficient expenses or contine cient financial incentives exist. (Zielinski-IPA) ws1-01005

PLANNING AND DESIGN OF STUDIES FOR RIVER-QUALITY ASSESSMENT IN THE TRUCKEE AND CARSON RIVER BASINS, CALIFORNIA AND NEVADA, Geological Survey, Carson City, NV. Water Resources Div.

For primary bibliographic entry see Field 6A. W81-01024

THE COLUMBIA RIVER: PROTEIN, POWER, PRESERVATION, AND POLITICS, Haggard, Tousley and Brain, Seattle, WA.

J. E. Haggard. In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80. July, 1980, p 33-

Descriptors: *Columbia River, *Irrigation, *Hydroelectric power, *Hydroelectric power plants, *Anadromous fish, *Consumptive use, Wildlife, Water allocation(Policy), Beneficial use, Federalstate water rights conflicts, Jurisdiction, Local governments, State governments, Planning, Dams.

The Columbia River is not just a power resource. It is also used for transportation, flood control, it is also used for transportation, flood control, irrigation, recreation, water supply, flow augmen-tation, fishing, tourism, and habitat for anadromous fish, wildlife and water fowl. With increasing usage, it is evident that existing water supply is not usage, it is evident that existing water supply is not adequate to meet all expected consumptive and instream river uses. Any future commitment of the Columbia's water will involve a cost or tradeoff to some other water use. What is done in one locality affects many others. The use of the river, therefore, requires a system of allocation which recognizes the diversity of interest and demand. A method of dispute resolution is needed that ad-dresses reasonable claims without sacrificing the interests of uninvolved or inactive users. A reasonable accommodation must be made between in-stream and out-of-stream users, and among users in each category. Future needs should be recognized each category. Future needs should be recognized while realizing that our present perceptions of these needs will vary. A compact between the states and the federal government is desirable; however, political realities may prevent the fruition of an interstate compact for the river in this century. (Atkins-Omniplan)
W81-01198

6E. Water Law and Institutions

FISCAL 1980 ANNUAL REPORT TO OFFICE OF WATER RESEARCH AND TECHNOLOGY,

Pennsylvania State Univ., University, PA. Inst. for Research on Land and Water Resources.

Available from the National Technical Information Service. Springfield. VA 22161 as PB81-147811. Price codes: A05 in paper copy, A01 in microfiche. December 1980, 92 p.

Descriptors: *Pennsylvania, Acid mine water. *Information retrieval, *Water supply, *Projects, Water pollution control, Pollutant identification.

WATER RESOURCES PLANNING—Field 6

Water Law and Institutions-Group 6E

Floods, Water quality control, Resources development, Water conservation, Waste treatment, Potable water, Runoff, Erosion, Infiltration, Heavy metals, Streams, Mine drainage, Ecology, *Watershed management, Evaluation, Renovation of wastewater, Technology transfer, Spray irrigation, Nonpoint source pollution, Mound systems, Stream eutrophication, Acid snow.

This publication is the Fiscal 1980 Annual Report of the Water Resources Center, Institute for Re-search on Land and Water Resources, The Pennsylvania State University. In its reporting of the OWRT funded allotment and matching grant research projects, the report satisfies the reporting requirements of the Office of Water Research and Technology under P.L. 88-379. In addition to the Director's summary statement and a narrative report for each project, the training and education aspects of the Water Research Program under P.L. 88-379 are reported. Numerous broad lines of research are reported with concentrations in the following areas: water supply, water quality man-agement and control, planning for future resource development, water conservation, water utility fi-nancing, low flow requirements for in-stream use, nonpoint source pollution, innovative waste treat-ment, on-site effluent disposal mound system evaluation, study of acid snow, effects of spray irriga-tion on wildlife, and acid mine drainage. (Tsong-W81-01004

CONCERN OVER THE COLUMBIA ESTUARY. Pacific Northwest River Basins Commission, Van-R. Moulton

R. Moutton.
In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80, July, 1980, p 13-27. 1 Fig. 8 Ref.

Descriptors: *Columbia River, *Washington, *River Basin Commissions, *Estuaries, Watershed protection, Allocation(Cost), Pacific Coast region, Resource allocation, Water resources development, Regional development.

The need to allocate the use of the Columbia The need to allocate the use of the Columbia River's resources has forced government to plan, make judgements and enforce these judgements through a variety of mechanisms. Except for an investigation by the Atomic Energy Commission in the early 1960's, no comprehensive study of the estuary's resources has been made until recently. To coordinate the efforts of Washington and Oregon, the Columbia River Estuary Study Task-force (CREST) was formed in 1975. In 1967, the Pacific Northwest River Basins Commission (PNRBC) was established to coordinate water re-(PNRBC) was established to coordinate water re-Sources activities in the five Pacific Northwest States. One of its purposes was to undertake spe-cial studies of water and related land resources. cial studies of water and related land resources. For this reason, the Columbia River Estuary Data Development Program (CREDDP) was initiated. The CREDDP's purpose is twofold: to increase understanding of the Columbia River Estuary as a system, and to acquire information needed for making specific land/water management systems. Funding is provided by Public Works Bill P.L. 95-482. The program will be in seven phases over a six-year period. Policy guidance will be through the PNRBC. Technical guidance will come from a Technical Advisory Committee working through a Technical Advisory Committee working through a Program Manager who is on the Committee staff. The work of the program is being performed by a mix of 18 federal/state agencies, academic institutions, and private contractors or individuals working on 28 contracts. Roles, functions and services to be provided by these groups or individuals are described. A summary of the 28 contracts, includ-ing dollar amounts, is listed. (Atkins-Omniplan)

EFFECTIVE WASTEWATER MANAGEMENT PLANNING FOR SMALL COMMUNITIES -

PART 2, California Univ., Davis. Dept. of Civil Engineer-

R. F. Barror, and G. Tchobanoglous.

Public Works, Vol 111, No 9, p 125-127, 170, 172, 174, September, 1980. 1 Tab, 8 Ref.

*Management, management (Applied), *Planning, *Waste water treatment, Administration, Comprehensive planning, Design, Systems analysis.

Key innovative wastewater management planni concepts effective for small communities are discussed. The fact that small communities must examine the problems of waste water treatment from a different viewpoint is stressed. Simply scaling down large size operations is not necessarily the down large size operations is not necessarily ine-best approach. Even though these originally large-scale operations can still function on a small scale, they are often far more costly than a totally new design for a system on a small scale would have design for a system on a small scale would have been. Innovative planning is needed for the small community. Land and labor utilization must be considered. Three types of water treatment proc-esses which use land either directly or indirectly are ponds (oxidation ponds), land treatment sys-tems (crop irrigation, overland flow and rapid infitration) and aquatic systems (wetlands and aquaculture applications). Important aspects of labased systems for the small community are based systems for the small community are described. The effective utilization of labor is considered, including plans to hire unskilled labor through the use of welfare and unemployment funds. (Baker-FRC) W81-01083

MANAGEMENT AUDITS FOR THE 80°S. Andersen (Arthur) and Co., Hartford, CT. E. F. Bader.

Journal of the New England Water Works Association, Vol 94, No 3, p 240-254, September, 1980. 1

Descriptors: *Management, *Planning, *Regula-tion, *Audits, Productivity, Projections, Adminis-trative agencies, Public utilities.

Management audits in utilities by financial and regulatory agencies will increase in the next decade for the following reasons: strong demand for improved economy and efficiency, a high level of consumer activism, emphasis on improved productivity, and pressure on regulatory commissions. The 1980's may see these increasing trends: in-volvement of commissions in management's decision-making procedures, municipalization, emphasis on documentation to demonstrate efficiency, specialization in scope of audits, and communication with regulatory commissions and the public. tion win regularcy commissions and the public.

Managers may become better prepared for audits by conducting internal reviews, identifying areas for improvement with specific plans for these improvements, reducing exposure in high visibility areas, documenting accomplishments, and communicating actions and plans to the commissions. Specially in the property of the cific steps for organizing a pre-audit review are described. (Cassar-FRC) W81-01098

WATER PROBLEMS AND RESEARCH NEEDS FOR WISCONSIN, A 5-YEAR PLAN, Wisconsin Univ.-Madison. Water Resources

Center.

Center.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150203, Price codes: A06 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, September, 1980. 98 p, 9 Fig, 10 Tab, 22 Ref.

Descriptors: *Research priorities, *Wisconsin, *Planning, *Research and development, *Water quality, Water management(Applied), Water requality, Water management(Applied), Water re-sources, Water pollution, Institutions, Optimum development plans, Evaluation, Programs, Investi-gations, Project planning, Alternative planning, Water utilization, Toxins, Wetlands, Information exchange, Governments, *Five-year plans.

This report provides an overview of available information on Wisconsin's water resources, shore-lands, and water use, and includes a summary of State management and planning activities. This information provided the basis for categorization

of problem areas and identification of research needs in development of a five-year plan. Wisconsin's water resources were summarized under: general geology; precipitation and water budget; groundwater (covering quantity, quality and quality management); surface water (rivers/streams, surface water quantity/quality monitoring, inland and Great Lakes); wetlands; shorelands; and water use (river basins, waste water discharges, agriculture, navigation, recreation, fish/wildlife). The identified water research priorities for Wisconsin's five-year plan were developed into eight categories: hazardous materials in the environment; conpoint course pollution, waterlands, recreation, technology. needs in development of a five-year plan. Wisconsource pollution; wetlands, recreation; technology transfer, information dissemination, and education program; human health effects; and intergovern mental and intragovernmental activities. The eight identified priority categories were discussed detail. (Zielinski-IPA)
W81-01159

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN, FISCAL YEARS

1982-1986. Rutgers-The State Univ., New Brunswick, NJ. Water Resources Research Inst.

water Resources Research Inst.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150195, Price codes: A03 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, December, 1980. 42 p, 6 Fig. 9 Tab. 8 Ref. and Techn Tab. 8 Ref.

Descriptors: *Research priorities, *New Jersey, *Planning, *Research and development, *Water quality, Water management(Applied), Water requality, water management/Appired), water courses, Water pollution, Institutions, Optimum development plans, Evaluation, Programs, Investigations, Project planning, Alternative planning, Water utilization, Toxins, Chemicals, Storm water, Groundwater, *Five-year plans.

This report has described the current condition of New Jersey's water resources, has identified priority State issues likely to be of major concern during the next five years, and has proposed a research agenda to address priority problems. Twelve State-wide high-priority issues were defined: sewage treatment plant discharges; industrial discharges; landfill dumping; on-site disposal (septic); accidental spills/leaks; urban storm runoff; agricultural runoff/sepage; suburban/rural runoff; purveyor deficits; surface supplies reaching maximum properties of the supplies of th purveyor deticits; surface supplies reaching maximum development capacity; fragmentation of water supply network; and groundwater supplies reaching maximum development. Integration of issues identified five broad priority categories: water quality management planning; toxics and hazardous control; groundwater management; non-point source control; and point source control. The Institute's three key research priorities, identified Institute's three key research priorities, identified by assistance from response to the Institute's questionnaire, represent the proposed research agenda for the next five years: (1) impact research agenda for the next five years: (1) impact of hazardous and/or toxic chemicals on the quality of ground/surface waters; (2) stormwater and nonpoint source management issues; and (3) water quantity issues. Justification and research objectives of these three priorities were discussed. (Zielinski-IDA) IPA) W81-01160

THE ORR DITCH CASE, 1913-1944, Nevada Historical Society, Reno. J. M. Townley.

J. M. Towniey.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-150286. Price codes: A05 in paper copy, A01 in microfiche.

Water Resources Center, University of Nevada, Reno, Desert Research Institute Publication 43007, October, 1980. 90 p. 2 Tab. OWRT-A-080-NEV(1), A-087-NEV(1), 14-34-0001-8030, 14-34-

Descriptors: "History. "Water rights. "Rivers. "Water utilization. "Judicial decision. Riparian rights. River basin development. Biographies Legal aspects. Water law, Jurisdiction. Bodies of water, Nevada, Institutional constraints. Adminis-Water policy, Legislation. Reservation

Field 6-WATER RESOURCES PLANNING

Group 6E-Water Law and Institutions

Water doctrine. Project planning. management(Applied)

management(Applied).

The first cooperative report of the Nevada Historical Society and the Desert Research Institute's Water Resources Center describes the results of a project, the objective of which was to make the Orr Ditch case and succeeding litigation understandable in a humanistic sense. Hence, considerable use was made of the term 'equity', and the report has focused on a comparison of the suit's results with the concept of an equitable division of water resources among Truckee River users, rather than legal formalities. This report has also examined the motives and actions of the major parties involved. The case, which arose from the government's need to rectify its management of the Truckee-Carson project, took over three decades (1912-1944) of courtroom argument and detailed field analysis to complete. The final decree (1944) erpetuated earlier findings and contained no significant variance to the Truckee River Agreement perpetuated earner things and contained to sig-nificant variance to the Truckee River Agreement of 1935. From experience of the Orr Ditch suit, this report concluded that, once finite water rights are identified, they must be enforced by an agency that is free of influence of water users, and that will distribute resources statutorily; otherwise a regulatory decree quickly becomes nonfunctional. (Zielinski-IPA)
W81-01161

PLANNING FOR FISCAL YEARS 1982/1986.
Delaware Univ., Newark. Water Resources

Available from the National Technical Information Available from the National I echnical information Service, Springfield, VA 22161 as PB81-150260, Price codes: A05 paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, November, 1980. 83 p, 6 Fig, 9 Tab, 15 Ref, 2 Append.

Descriptors: *Research priorities, *Delaware, *Planning, *Research and development, *Water quality, Water management(Applied), Water resources, Water pollution, Institutions, Optimum development plans, Evaluation, Programs, Investi-gations, Project planning, Alternative planning, Water utilization, Toxins, Groundwater, Delaware River, Bays, *Five-year plans.

This five-year report covered State geological information (aquifers, surface water, climate, land use), water quality and use, governmental and other agencies and their anticipated fiscal year 1981 activities, Delaware's water problem categories, and has identified research priorities. The five-year plan was presented in two forms: (1) the foreseeable immediate future and factors that will guide the State water resources Center's decisions; and (2) a fiscal breakout for the five-year plan. Identified Delaware water problems were discussed under water resources planning/management, water supply (including distribution systems and quality), groundwater contamination, and waste treatment/disposal categories. Thirteen research priorities were classified as either critical, urgent, or important. Critical area priority categories were: atmospheric, hydrologic, and hydraulic processes (groundwater contamination from land-fill/waste disposal sites; predictive subsurface contaminant migration study); water resources management (economics study for water conservation program for public/industrial/agricultural sectors); and institutional, political, legal, behavioral, and economic analysis (evaluation of up-river manage-ment effects on Delaware River and Bay in Delaware). (Zielinski-IPA) W81-01163

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN, FISCAL YEARS Ohio State Univ., Columbus. Water Resources

R. L. Vertrees, and R. C. Stiefel.

R. L. Vertrees, and R. C. Stietel.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB81-150211,
Price codes: A04 in paper copy, A01 in microfiche.
Report submitted to the Office of Water Research
and Technology, October, 1980. 59 p, 3 Fig. 5 Tab,
71 Paf

Descriptors: *Research priorities, *Ohio, *Planning, *Research and development, *Water quality, Water management(Applied), Water resources, Water pollution, Institutions, Optimum development plans, Evaluation, Programs, Investigation, Project planning, Alternative planning, Water utilization, Toxins, Flooding, Drainage, *Five-year plans

Adequate water is available from precipitation, the Ohio River and Lake Erie to meet Ohio's immediate needs. Most of Ohio's water-related problems are associated with water quality. Large quantities of waste products are produced from point/diffuse sources, developing concerns in surface runoff from urban, agricultural and mining areas over the State. The potential contamination of groundwaters by toxic/hazardous wastes represents a critical water resources problem. Other major water-related problems include: impact assessment of water development projects on wetlands/recreof water development projects on wetaanox/tects-ational activities; quantification of instream flow needs to maintain aquatic organism species diversi-ty; and impact assessment of acid precipitation on State stream/lake water quality. Ten identified problem areas were prioritized in developing the State's five-year water resources research and development plan: (1) pollution from diffuse sources (agricultural/urban runoff, mine drainage, on-site (agricultural/urban runoff, mine drainage, on-site disposal); (2) drinking water contamination (surface/ground water); (3) toxic/hazardous waste disposal (land disposal, ground/surface water); (4) point source pollution; (5) impacts of flooding/drainage; (6) impacts of water resources development; (7) instream flow needs; (8) impacts of synthetic fuel development; (9) air pollution impacts; and (10) water supply allocation. (Zielinski-IPA) W81-01164

THE COLUMBIA RIVER: PROTEIN, POWER, PRESERVATION, AND POLITICS, Haggard, Tousley and Brain, Seattle, WA. For primary bibliographic entry see Field 6D. W81-01198

INTERNATIONAL MANAGEMENT OF THE COLUMBIA,
Oregon State Univ., Corvallis. Dept. of Geogra-

W. Muckleston.

In: Conflicts over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980, Report SEMIN WR 028-80. July, 1980, p 69-88. 4 Fig, 2 Tab, 26 Ref.

Descriptors: *Columbia River, *Canada, *Interna-tional waters, *Treaties, Hydrographs, Hydroelec-tric power, Reservoirs, Storage capacity, Irriga-tion, Streamflow, Flood control, Dams, Drainage basins, Pumped storage, Water policy.

An agreement between the United States and Canada for the cooperative management of the Columbia River was developed over two decades, involving the provision and operation of storage reservoirs in Canada. By the early 1950's, it was evident that utilities in the Pacific Northwest evident that utilities in the Pacific Northwest would have difficulty meeting the growing peak demands for electrical energy during the fall and winter seasons. Shortfalls in the planned additional increments of upstream storage were at the root of the problem. In 1959, after fifteen years of study, the International Joint Commission presented alternative plans for development, noting that storage sites in Canada could be operated to the benefit of both countries. The Commission also calculated an apportionment of the costs/benefits to each countries. apportionment of the costs/benefits to each country. Before implementation, the U.S. had to agree to benefit sharing: an equal division between the upstream and downstream countries of benefits of storage in the upstream country as a result of storage in the upstream country. Quantifying the downstream benefits was complex, however, the downstream benefits was complex, nowever, an agreement was reached in 1960 and the Columbia River Treaty was signed in 1961. The Protocol finalizing the Treaty was signed in 1964 after Canadian factions reached agreement on their distribution of the benefits. The Treaty's main water-related concerns were hydroelectric generation and flood mitigation. Which country benefited

most is debatable but both received large blocks of electrical energy at a lesser cost than if developed independently. Future negotiations will consider flow augmentation, water quality enhancement, irrigation and recreation. (Atkins-Omniplan) W81-01201

6G. Ecologic Impact Of Water Development

CONSERVATION V. LAND DRAINAGE - A GUIDE FOR THE FUTURE,

Water Space Amenity Commission, London (Eng-For primary bibliographic entry see Field 6A. W81-01048

OFFSHORE WATER INTAKES DESIGNED TO PROTECT FISH,
Stone and Webster Engineering Corp., Boston,

Stone and Webster Engineering Corp., Boston, MA. Hydrology Div. Y. G. Mussalli, E. P. Taft, and J. Larsen. Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No Hy 11, p 1885-1901, November, 1980. 9 Fig, 21

Descriptors: *Hydraulic structures, *Fish barriers, *Water cooling, Fish harvest, Fish passages, Intakes, Fish behavior, Fish repellents, Infiltration, Environmental effects, Screens, Saline water fish,

Cooling water intake structures situated at offshore locations frequently face problems of impingement and entrainment of fish. Not only does the entrapment of fish deter efficient water intake, but the loss of fish may affect future fish harvests and endanger populations of certain marine habitats. Five concepts to prevent the entrance of fish into cooling water intake equipment are reviewed to familiarize designers with the advantages and problems associated with each. The systems discussed include velocity caps, wide-spaced louvers, behavioral barriers, wedge-wire screens and infiltration intakes. Radial wells and wedge-wire screens are the most effective in preventing fish impingement; however, more work is needed for use of wedgenowever, more work is needed for use or wedge-wire screens in once-through cooling systems. Be-havioral barriers offer only limited prevention of fish entrainment. More research is also needed on the wide-spaced louver concept to make it a viable method of bypassing fish within offshore, velocity cap intakes. (Geiger-FRC) W81-01070

7. RESOURCES DATA

7A. Network Design

PROGRAMS REVAP AND WEVAP FOR ESTI-MATING AREAL EVAPOTRANSPIRATION AND LAKE EVAPORATION FROM CLIMATO-LOGICAL OBSERVATIONS

National Hydrology Research Inst., Ottawa (On-

For primary bibliographic entry see Field 2D W81-01017

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN COLO-RADO-FISCAL YEAR 1980.

Geological Survey, Lakewood, CO. Water Re-

sources Div. Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: \$16.75 in paper copy, \$4.00 in microfiche. Geological Survey Open-File Report 80-442, March, 1980. 111 p. 39 Fig, 1 Plate, 1 Tab. (Compiled by Blakely, S. R.).

Descriptors: *Water resources, *Colorado, *Surface waters, *Groundwater, *Water quality, Basic data collection, Projects, Maps, Colorado River basin, Missouri River basin(CO), Arkansas River basin(CO), Rio Grande basin(CO).

Data Acquisition—Group 7B

Water-resources data-collection activities for Octo-Water-resources data-collection activities for Octo-ber 1, 1979, through September 30, 1980, are sum-marized for Colorado and bordering States. Fifty-four interpretive hydrologic investigations include: 9 statewide investigations, 6 regional investiga-tions, 11 investigations in the Missouri River basin, 7 investigations in the Arkansas River basin, 3 investigations in the Rio Grande basin, 16 investi-gations in the Colorado River basin, and 2 multi-state investigations. The summaries of the investiga-tions conseit of a way showing the location of the tate investigations. The summaries of the investigations consist of a map showing the location of the areas of investigations and a brief description of the investigation's purpose, objective, approach, progress, and plans. (USGS)
W31-01182

U.S. GEOLOGICAL SURVEY ACTIVITIES IN

NEW YORK, 1979. Geological Survey. Albany, NY. Water Resources

Geological Survey Open-File Report 80-51, 1980. 124 p, 9 Fig, 2 Tab, (Finch, A., and Gori, P.,

Descriptors: *New York, *Natural resources, *Projects, *Programs, Water resources, Land use, Mineralogy, Fuels, Water quality, Geologic investigations, Mapping, Energy, Bibliographies, *U.S. Geological Survey.

This report describes the work of the U.S. Geological Survey and summarizes projects conducted in New York during 1979. Many of these projects are continuing into the 1980's. The major programs provide basic scientific information concerning water, land, and mineral resources. The Survey also supervises the exploration for mineral fuels on leased outer continental shelf lands. The programs are: (1) Water resources investigations--These encompass (a) statewide networks of measurement stations that provide continuous records of stream-flow, groundwater levels, water quality, and sediment discharge, and (b) projects to study local or regional water problems as well as critical water problems of national scope or interest. (2) Geologic and mineral resource surveys and mapping—These studies focus on geologic, mineral, and energy-resources investigations both on land and offshore. (3) Conservation of lands and mineral resources—These studies include the classification and evaluation of mineral resources on the outer. compass (a) statewide networks of measurement resources--I hese studies include the classification and evaluation of mineral resources on the outer continental shelf. (4) Topographic surveys and mapping-These studies include quadrangle, small-scale, and special mapping. (5) Land information and analysis--These studies focus on the interpretation and application of earth-science and related information to multi-disciplinary land-resource and environmental-impact problems. (USGS)

HYDROLOGIC INVESTIGATIONS IN THE ARAGUAIA-TOCANTINS RIVER BASIN (BRAZIL),

Geological Survey, Ocala, FL. Water Resources

L. J. Snell. L. J. Snell. Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: \$4.25 in paper copy, \$4.50 in microfiche. Geological Survey Open-File Report 79-1599, 1979. 28 p, 5 Fig.

Descriptors: *Water resources development, *Net-works, *River basins, Hydrologic data, Meteoro-logical data, Gaging stations, Stream gages, Rain gages, *Brazil, *Rio Araguaia, *Rio Tocantins, gages, *Brazil, *Project planning.

The Araguaia-Tocantins River basin system of central and northern Brazil drains an area of about 770,000 square kilometers and has the potential for supporting large-scale developments. During a short visit to the headquarters of the Interstate Commission for the Araguaia-Tocantins Valley and to several stream-gaging stations in June 1964, the author reviewed the status of the streamflow the author reviewed the status of the streamflow and meteorological data-collection programs in re-lation to the streamflow and meteorological data-collection programs in relation to the pressing needs of development project studies. To provide data for areal and project-site studies and for main-stream sites, an initial network of 33 stream gaging

stations was proposed, including the 7 stations then stations was proposed, including the 7 stations then in operation. Suggestions were made in regard to operations, staffing and equipment. Organizational responsibilities for operations were found to be divided uncertainly. The Brazilian Meteorological Service had 15 synoptic stations in operation in and near the basin, some in need of reconditioning. Plans were at hand for the addition of 15 sites to the synoptic network and for limited data collection at 27 other sites. The author proposed collection to 70 others itself. tions to achieve a more representative areal distri-bution. Temperature, evaporation, and upper-air data sites were suggested to enhance the prospec-tive hydrometeorological studies. (USGS) W81-01188

7B. Data Acquisition

REMOTELY SENSED CROP TEMPERATURE FOR WATER RESOURCES MANAGEMENT. Nebraska Univ.-Lincoln. Center for Agricultural Meteorology and Climatology.

Available from the National Technical Information Available from the National 1 echnical information Service, Springfield, VA 22161 as PB81-147795, Price codes: A12 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska, Project Completion Report, November, 1980. 247 p. 87 Fig. 18 Tab, 121 Ref, 4 Append. OWRT-B-044-NEB(2), 14-34-0001-8097.

Descriptors: *Crop temperature, Water stress, Irrigation scheduling, *Remote sensing, Evapotranspiration, *Crop response, *Temperature, Crop production, Forecasting, Irrigation practices, Water management(Applied).

The overall goal of the project was to evaluate the The overall goal of the project was to evaluate the use of crop temperature data as a tool in the management of water resources. The specific objectives of the study were: (1) to determine the crop temperature response of some major agronomic crops to various levels of water stress; (2) to test methods based on crop temperature or other remotely sensed data to estimate crop water stress conditions and to evaluate the utility of these methods for their ability, to estimate conveidts exterconditions and to evaluate the during of these meta-tion ods for their ability to estimate crop yields, sever-ity of water stress and crop phenological develop-ment; and (3) to determine the feasibility of using crop temperature as a guide for irrigation scheduling. Crop temperatures were measured with an infrared thermometer, with attached leaf thermocouples and with airborne multispectral scanners. Corn and sorghum were the principal crops studied. Some data were also obtained for soybeans and alfalfa. Results of the studies suggest that crop and anian. Results of the studies suggest that crop temperature data can be used to assess crop water status. As such, crop temperature data can be used for scheduling irrigation, for detecting and moni-toring effects of limited availability of water to crops, for evaluating the effectiveness of various irrigation scheduling techniques, for examining the irrigation screeduing techniques, for examining the uniformity of water application by various irrigation systems, for detecting soil areas with low water holding capacities, and as a means to select plant types which are most effective in tolerating or avoiding shortages of water.

W81-01002

PROGRAM LAYOUT - AN INTERACTIVE PROGRAM TO HANDLE PAGE LAYOUT FOR DOCUMENTATION OF COMPUTER FILES PRINTED ON-LINE AT REMOTE TERMI-

NALS, National Hydrology Research Inst., Calgary (Al-

berta). W. C. Horwood, and K. U. Weyer. NHRI Report No 9, 1980. 60 p, 9 Tab, 5 Append.

Descriptors: *Computer programs, *Remote terminals, LAYOUT, Automatic printout, *Documentation, Program listings, Program outputs, Hydrologic data, *Publications, *Information retrieval,

The documentation of program listings and program outputs for reports and publications is a tedious and time consuming procedure subject to errors. It is best done automatically using the files

and the facilities of the computer itself. Computer files, however, are generally stored as continuous streams of information. Printing of these files as istreams of Information.

Information and unstructured listings, which are very laborious to read. In theory, the final structure of the listings and the layout of the printing faces can be fully anticipated layout of the printing faces can be fully anticipated at the time of programming. This, however, has proven to be a complicated, cumbersome and time-consuming procedure. All of these disadvantages can be efficiently overcome by using a general purpose program to structure automatically for printing by the computer any computer listing, program input or output stored on magnetic files. To the best knowledge of the authors, program LAYOUT is the first general program of this kind. The design of the page layout for the final printing is prepared interactively at a remote terminal. Automatic printing of the final structured file is also routed to remote terminals to avoid some of asso found to learnote terminals to avoid soline to the disadvantages of main printers of computers such as their automatic response to formatting commands often included in program output. (WATDOC) W81-01014

USE OF GEOPHYSICAL LOGS TO ESTIMATE WATER-QUALITY TRENDS IN CARBONATE AQUIFERS,
Geological Survey, Denver, CO. Water Resources

Geological Survey, Denver, CO. Water Resource Div.
L. M. MacCary.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-224124, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-57, 1980. 23 p, 8 Fig, 2 Tab, 18 Ref.

Descriptors: *Logging(Recording), *Borehole geophysics, *Water quality, *Electric well logging, Aquifer characteristics, Carbonate rocks, Resistivity, Porosity, Analytical techniques, Evaluation, Montana, North Dakota, South Dakota, Wyoming, Apparent water resistiv-

The water quality in carbonate aquifers can be determined by analysis of resistivity and porosity logs. When supporting data from water analyses are available, the value of the cementation exponent m can be determined more precisely. Data for this study were taken from logs of oil-test wells, this study were taken from logs of oil-test wells. Amstrat sample studies, drill-stem tests and water test wells in parts of Montana, North and South Dakota, and Wyoming. The preferred resistivity (Rwa) analyses are the deeply focused laterolog and the induction log. The standard electric log can be used if the drilling mud is not saturated with salt. The preferred porosity logs are the sonic, sidewall neuron, compensated neutron, and the density logs. tron, compensated neutron, and the density logs. Older, uncalibrated neutron curves can be empiri-Older, uncalibrated neutron curves can be empiri-cally calibrated in some instances, however, result-ing porosities are frequently anomalous when com-pared to those determined from core or modern logs. When apparent water resistivity is deter-mined for many wells, the data can be plotted and contoured to outline areas of recharge, direction of probable ground-water movement, and location and salinity of brine areas. (USGS) W81-01029

AERIAL INFRARED PHOTOGRAPHY FOR FLOOD PLAIN INVESTIGATIONS, Institute of Hydrology, Wallingford (England). K. Blyth, and G. P. Nash. Journal of the Institution of Water Engineers and Scientists, Vol 34, No 5, p 425-434, 1980. 4 Fig. 1 Tab, 10 Ref.

Descriptors: *Flood profiles, *Aerial photography, *Infrared radiation, Flood data, Mapping, Films. Color, Thames River(England).

Flood mapping from low-cost aerial photographs reduces demands on staff resources, improves the quality and quantity of flood data, and provides a visual record of the flood plain. Light aircraft is used and both vertical and oblique photographs are taken with 35 mm cameras. The effectiveness of the system was evaluated in a series of flights over

Field 7—RESOURCES DATA

Group 7B-Data Acquisition

the flooded Thames in February 1977, and in a study of the Rivers Lee and Roding upper catchments in May 1978. The total cost of the Thames project was 6.25 British Pounds Sterling per km including interpretation and mapping. The oblique, color infrared aerial photographs, taken up to a week after maximum flood extent, were an effective method of mapping maximum flood extent. (Small-FRC) W81-01055

DEVELOPMENT OF A MODEL FOR ESTI-MATING THE EXTENT OF RIVER FLOOD-ING WITH SATELLITE AND IN SITU DATA, Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering. W. R. Philipson, J. N. McLeester, and W. R.

Halker.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB81-152035,
Price codes: A05 in paper copy, A01 in microfiche.
Project Technical Completion Report, November,
1980. 26 p. 7 Fig, 3 Tab. OWRT-A-089-NY(1), 1434-0001-0134.

Descriptors:

*Satellites(Artificial), *Flood forecasting, Data processing, *Model studies, River basins, Aerial photography, Photogammetry, New York, *Black River basin(NY), *Landsat, *Multispectral scanner data, *Image analysis.

The value and use of Landsat satellite data for obtaining information on flooding were assessed in this study of the Black River Basin in northern New York. The investigation had three parts. Initially, the reliability of delineating flood-affected areas from Landsat data was established by comparison with flood boundaries derived from aerial parison with flood boundaries derived from aerial photographs of a different but similar flood. Secondly, it was established that the delineation of flood-affected areas could be performed through visual analysis of band 7 (near-infrared) Landsat images as reliably as it could through color-additive viewing or digital analysis using all Landsat bands or scenes of different dates (flooding and no flooding). Lastly, a preliminary predictive model was developed which uses in situ measurements of view discharges to estimate the extent of flooding. river discharge to estimate the extent of flooding. This model was derived by statistically relating in situ measurements of discharge to Landsat-derived measurements of the area and location of flooding. W81-01203

7C. Evaluation, Processing and Publication

FISCAL 1980 ANNUAL REPORT TO OFFICE OF WATER RESEARCH AND TECHNOLOGY,

Pennsylvania State Univ., University, PA. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 6E. W81-01004

STATISTICAL ANALYSES OF SURFACE-WATER-QUALITY VARIABLES IN THE COAL AREA OF SOUTHEASTERN MONTANA, Geological Survey, Helena, MT. Water Resources

For primary bibliographic entry see Field 5B. W81-01023

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1979.

Geological Survey, Helena, MT. Water Resources

Geological Survey Water-Data Report MT-79-1, July, 1980. 842 p, 10 Fig. 5 Tab.

Descriptors: "Montana, "Hydrologic data, "Surface waters, "Groundwater, "Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport. Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Montana consist of records of stage, discharge, and

water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for wells. This report contains discharge records for 1 lake station; stage and contents for 9 lakes and reservoirs; water quality for 137 stations, 3 lakes; and water levels for 23 observation wells. Also included are 172 crest-stage partial-record stations and 43 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data-collection programs, and are published as miscellaneous measurements. These data represent that part of the National Water Data System oper-ated by the U.S. Geological Survey and cooperat-ing State and Federal agencies in Montana. ing Sta

WATER RESOURCES DATA FOR PUERTO RICO, WATER YEAR 1977, SURFACE AND QUALITY-OF-WATER RECORDS AND GROUND WATER RECORDS.

Geological Survey of Puerto Rico, San Juan. Water Resources Div. Geological Survey Water-Data Report PR-77-1, July, 1980. 204 p, 19 Fig, 3 Tab, 25 Ref.

Descriptors: *Puerto Rico, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for surface-water, quality-of-water, and ground-water records for 1977 water year for Puerto Rico consist of records of dis-charge, water quality of streams, and water levels of wells. This report contains discharge and waterquality records for 35 gaging stations, 74 water-quality stations, and water levels for 58 observaquality stations, and water levels for 38 observa-tion wells. Also included are data for 17 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and the Common-wealth of Puerto Rico. (USGS) W81-01040

WATER RESOURCES DATA FOR PENNSYL-VANIA, WATER YEAR 1979--VOLUME 1. DELAWARE RIVER BASIN.

Geological Survey, Harrisburg, PA. Water Re-Geological Survey, Harrison, Francisco, Francisco, Sources Div.
Geological Survey Water-Data Report PA-79-1, September, 1980. 297 p. 12 Fig. 3 Tab.

Descriptors: *Pennsylvania, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Delaware River basin(PA).

Water resources data for the 1979 water year for Pennsylvania consist of records of discharge and water quality of streams, contents of lakes and reservoirs, and water levels of ground-water wells. This report, Volume 1 (Delaware River basin), contains records for water discharge at 73 agains contains records for water discharge at 73 gaging contains records for water discharge at 73 gaging stations, contents at 11 lakes and reservoirs, water quality at 39 gaging stations and water levels at 16 observation wells. Also included are data for 43 crest-stage, 28 low-flow, and 43 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection programs and are published as miscellaneous measurements and analyses. These as miscellaneous measurements and analyses. These data together with the data in Volumes 2 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Pennsylvania. (USGS)
W81-01042

GEOLOGY AND GROUND WATER IN NORTH-CENTRAL SANTA CRUZ COUNTY,

Geological Survey, Menlo Park, CA. Water Resources Div.

Available from the National Technical Information Available from the National 1 echnical information Service, Springfield, VA 22161 as PB81-113243, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-26, September, 1980. 33 p, 7 Fig. 3 Tab, 37 Ref.

Descriptors: *Groundwater potential, *Aquifer characteristics, *Groundwater availability, *Water quality, *California, Hydrogeology, Geohydrologic units, Test wells, Groundwater recharge, Evaluation, *Santa Cruz County(CA).

North-central Santa Cruz County is underlain mainly by folded sedimentary rocks of Tertiary and Cretaceous age that have been highly frac-tured by movements in the San Andreas frac-tured by movements in the San Andreas frac-tured by movements in the San Andreas fracsystem. Ground water is stored in fractures within shale and mudstone formations and in intergranular pore spaces within fine- to very fine-grained sandstone and siltstone formations. Fewer than 10% of the wells yield more than 15 gallons of water per minute. The water in most wells is moderately hard to very hard, is generally of a sodium bicarbonate or calcium bicarbonate type, and commonly has excessive concentrations of iron or mangages. Of the more recolorie units in the study ages ly has excessive concentrations of iron or change-nese. Of the many geologic units in the study area, only the Purisima Formation of Pliocene age has the potential to sustain well yields greater than 100 gallons per minute. (USGS) W81-01044

THIRD-ORDER INTEGRAL RELATION BE-TWEEN SORPTIVITY AND SOIL WATER DIF-FUSIVITY USING BRUTSAERT'S TECH-

NIQUE, Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 2G. W81-01076

WATER RESOURCES DATA FOR WASHING-TON, WATER YEAR 1979--VOLUME 1. WEST-ERN WASHINGTON.

Geological Survey, Tacoma, WA. Water Resources Div. Geological Survey Water-Data Report WA-79-1, October, 1980. 433 p. 22 Fig.

Descriptors: *Washington, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Western Weshington

Water Resources data for the 1979 water year for Washington consist of records of stage, discharge, wasnington consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water upon water quality of ground-water wells. This report in two volumes contains records for water discharge at 237 gaging stations, stage only at 5 gaging stations, stage and contents at 43 lakes. and reservoirs, water quality at 135 gaging stations (including 6 lakes and reservoirs) and 100 wells. Also included are data for 88 crest-stage, and 89 waterquality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (USGS) W81-01176

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1979--VOLUME 2. EAST-ERN WASHINGTON.

Geological Survey, Tacoma, WA. Water Resources Div. Geological Survey Water-Data Report WA-79-2, October, 1980. 314 p. 19 Fig.

Descriptors: *Washington, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment

Structures—Group 8A

transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Eastern Washington.

Water Resources data for the 1979 water year for Washington consist of records of stage, discharge, and water quality of streams, stage, contents, and water quality of lakes and reservoirs; and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 237 gaging stations, stage only at 5 gaging stations, stage and contents at 43 lakes and reservoirs, water quality at 135 gaging stations (including 6 lakes and reservoirs) and 100 wells, and water levels at 164 observation wells. Also included are data for 88 crest-stage, and 89 water-quality partial-record stations. Additional water quality artial-record stations. Additional water published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (USGS)

WATER RESOURCES DATA FOR MISSOURI, WATER YEAR 1979

WATER YEAR 1979.
Geological Survey, Rolla, MO. Water Resources

Div. Available from the National Technical Information Service, Springfield, VA 22161 as PB80-220478, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MO-79-1, October, 1980. 320 p, 3 Fig.

Descriptors: *Missouri, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport. Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections. Sites

Water resources data for the 1979 water year for Missouri consist of records of stage, discharge, and water quality of streams; stage, contents of water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 119 gaging stations, stage only at 3 gaging stations stage and contents at 6 lakes and reservoirs, and water quality at 32 gaging stations (including 1 lake) and 3 wells. Also included are data for 114 crest-stage, and 11 water-quality partial-record stations. (USGS)

WATER RESOURCES DATA FOR WEST VIRGINIA, WATER YEAR 1979.

GINIA, WATER YEAR 1979.
Geological Survey, Charleston, WV. Water Resources Div.

Geological Survey Water-Data Report WV-79-1, August, 1980. 417 p, 4 Fig.

Descriptors: *West Virginia, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for West Virginia consist of records of stage, discharge, and water quality of streams and springs; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 117 gaging stations, stage only records for 8 gaging stations, stage and contents for 7 lakes and reservoirs, contents for 1 reservoir, change in contents for 1 reservoir, water quality for 92 gaging stations, and water levels for 34 observation wells. Also included are 2 crest-stage partial-record stations, and 1 low-flow partial record station. Additional water data were collected at various sites, not part of the systematic data-recollection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia. (USGS)

W81-01179

A STATISTICAL ANALYSIS OF THE QUALITY OF SURFACE WATER IN NEBRASKA.

Geological Survey, Lincoln, NE. Water Resources

R. A. Engberg.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB80-227895,
Price codes: A13 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations
0-43, June, 1980. 277 p, 14 Fig. 9 Tab, 19 Ref.

Descriptors: *Water quality, *Surface waters, *Chemical analysis, *Biological properties, *Ne-braska, Streamflow, River basins, Sampling, Sites, Water analysis, Equations, Regression analysis, Correlation analysis, Specific conductivity, Planning, Water quality control.

This report provides descriptive statistics for 29 chemical or biological constituents for 109 stream sites in Nebraska sampled by the U.S. Geological Survey beginning in 1946. Also provided for each site are regression equations relating specific conductance to each of 12 chemical constituents and a regression equation relating specific conductance to stream discharge. The descriptive statistics are presented by river basins. Water leaving these basins that has the lowest mean specific conductance (266 umho/cm) is from the Niobrara River at Verdel, and water that has the highest (1,890 umho/cm) is from the South Platte River at Roscoe. Statewide, the principal cations in streamflow are calcium and sodium, and the principal anions are bicarbonate and sulfate. Calcium and bicarbonate usually predominate where mean specific conductance is less than 1,000 umho/cm, and sodium and sulfate predominate where the mean exceeds 1,000 umho/cm. Based on regression equations, dissolved solids, hardness, calcium, magnesium and bicarbonate, with some exceptions, correlate well with specific conductance for all stream sites. Illustrations of how regression equations may be used to estimate water quality of streamflow are given and are compared with values from actual analyses. (USGS)

GROUND-WATER LEVELS IN NEW MEXICO,

1977, Geological Survey, Albuquerque, NM. Water Re-

sources Div. J. D. Hudson.

New Mexico State Engineer Basic Data Report, 1980. 131 p, 35 Fig, 56 Tab.

Descriptors: *Groundwater resources, *Observation wells, *Water level fluctuations, *Water utiliization, *New Mexico, Hydrologic data, Basic data collections, Aquifers, water, Publications. Groundwater, Publications.

Water levels are measured periodically in a network of about 5,000 observation wells to record changes in groundwater storage. About 1,000 wells are measured annually and the remaining 4,000 wells are scheduled to be measured at 5-year periods, staggered so that a portion are measured each year. The areas of water-level observation are within seven of the nine major surface-water drainage basins; most are in areas where groundwater is used in large quantities for irrigation, municipal, or industrial purposes. Water-level measurements were made in January or February 1978. Intensive-coverage measurements were made in the Animas and Lordsburg valleys, Playas basin, and Carlsbad area. Tables of water-level data for these areas show change in water levels for 1973-78. Maps showing 5-year water-level changes for the four areas are also included. A bibliography of papers and publications pertaining to groundwater in New Mexico and adjacent areas published or released to the open file in 1977, with additions from 1848-1976 is included. (USGS)

WATER-QUALITY MONITORING OF THREE MAJOR TRIBUTARIES TO THE CHESA-PEAKE BAY-INTERIM DATA REPORT,

Geological Survey, Towson, MD. Water Resources Div.

sources Div.
D. J. Lang, and D. Grason.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113888, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-78, September, 1980. 66 p, 1 Fig, 5 Tab, 9 Ref.

Descriptors: "Water quality, "Basic data collections, "Water analysis, "Rivers, "Chesapeake Bay, Bays, Sampling sites, Sediment transport, Sediments, Bottom sediments, Nutrients, Trace elements, Pesticides, Herbicides, Insecticides, Potomac River, James River(VA), Susquehanna River(MD).

The U.S. Geological Survey is monitoring the water quality of three major tributaries to the Chesapeake Bay at their fall lines in order to obtain estimates of constituent inputs potentially available to the Bay. The monitoring sites are: Susquehanna River at Conowingo, MD.; Potomac River at Washington, DC.; and James River at Cartersville, VA. Water-quality data collected from October 1978 to April 1980 are presented in tabular format. Concentrations of major ions, nutrient and carbon species, metals, pesticides, suspended sediment, and other selected constituents are presented for a range of flows. The mean, standard deviation, minimum, maximum, and median values for each constituent were determined by standard methods and are presented for each sampling station. Bivariate linear regressions were run for all constituents versus streamflow, specific conductance, and suspended sediment. Those relationships exhibiting coefficients of determination greater than 0.50 are tabulated. (USGS)

MAPS SHOWING SATURATED THICKNESS, JANUARY 1979, AND PERCENTAGE DE-CREASE IN SATURATED THICKNESS, 1950-79, OF UNCONSOLIDATED AQUIFER, WEST-CENTRAL, KANSAS, Geological Survey, Garden City, KS. Water Re-

Geological Survey, Garden City, KS. Water Re sources Div.

Geological Survey Open-File Report 79-1340, December, 1979. 3 p. 2 Plates, 5 Ref.

Descriptors: *Maps, *Unconsolidated aquifers, *Kansas, Groundwater, Aquifer characteristics. Water wells, Water yield, Irrigation, Water levels, Withdrawal, *West-central Kansas, *Ogallala Formation, Saturated thickness.

The principal water-yielding formation (unconsolidated aquifer) supplying water to wells in west-central Kansas is comprised of the Ogallala Formation and undifferentiated Pleistocene deposits. About 1,860 square miles of the area are underlain by sufficient saturated material to supply groundwater for irrigation. Saturated thickness in the area ranges from less than 50 feet to about 270 feet. Thickness of saturated deposits in the unconsolidated aquifer in west-central Kansas has decreased as a result of groundwater withdrawals, principally for irrigation. From 1950 to 1979, the decrease in saturated thickness was negligible in some areas and as much as 80 feet in other areas. The decrease, in a few areas, was nearly an 80% reduction of the initial (1959) saturated thickness. (USGS) W81-01195

8. ENGINEERING WORKS

8A. Structures

OFFSHORE WATER INTAKES DESIGNED TO PROTECT FISH,
Stone and Webster Engineering Corp., Boston.

MA. Hydrology Div.

For primary bibliographic entry see Field 6G.

W81-01070

MADE TO MEASURE, D. Morris.

Field 8—ENGINEERING WORKS

Group 8A—Structures

Water and Waste Treatment, Vol 23, No 8, p 26, 29, August, 1980.

Descriptors: *Construction materials, *Materials engineering, *Specifications, *Construction, *Fabrication, *Design data, *Structural shapes, Technology, Design standards, Tunnel linings, Costs, Dimensions, Structural steel, Structural analysis, Water tanks, Pipelines, Sewage treatment, Industrial materials and the standards of the standards of

Vessels used for water production, effluent treat-ment and for other industrial purposes are now being designed and manufactured from a variety of materials to meet specific requirements for modular treatment plants. The basic materials used for tanks are mild steel, stainless steel, aluminum, titantanks are mild steet, stainless steet, aluminum, titan-ium, glass reinforced resins, and thermoplastics. A variety of lining materials suitable for each tank are also available. Equipment to treat and control in-dustrial effluent is available from separate commer-cial manufacturers. Commercial contracts for the design and installation of a modular water production plant and an effluent treatment plant scribed. Modular treatment plants have wide appli-cation; they are efficient, fabricated in suitable materials, and readily available from commercial manufacturers. (Titus-FRC) W81-01074

NEW WAYS TO FIX LEAKY SEWERS,
Associates, Inc., Wheaton,

R. F. Nelson American City and County, Vol 95, No 9, p 39, 40, 42, September, 1980.

Descriptors: *Sewers, *Repairing, Manholes, Pipes, *Maintenance, Infiltration, Rates, Sliplining, Materials.

A rehabilitation program undertaken in Stream-wood, Illinois to update the sewage system called for sliplining 1546 feet of 24-inch diameter sewer, rehabilitating 991 out of 1154 manholes in the system, grouting leaky sewer lines, replacing cracked sewer lines, and disconnecting 850 private sector sources of inflow. These procedures have largely been completed with a resulting 50 to 70% largely been completed with a resulting 50 to 70% reduction in infiltration/inflow. Sewer backups are greatly reduced, and building permits in the community are no longer restricted. Most of the system's 255,000 lineal feet of sanitary sewer were vitrified clay pipe. About 80% of the 1154 manholes were precast concrete, and the rest were concrete block. The replaced 1546 feet of pipes were severely cracked due to root intrusion through defective joints and other factors. Sliplining was performed using a polyethylene pipe with an outside diameter of 22.05 inches and a wall thickness of 1.248 inches. To replace and reseal the frame grade adjustments to manholes, the manholes. frame grade adjustments to manholes, the manhole was hand excavated to the cone section. Frame and grade adjustments were removed and the sur-face of the cone section was cleaned for preparation of a gasket material. A flexible rubber-like gasket was placed around the entire circumference of the cone section at about the midpoint of the of the cone section at about the midpoint of the wall. Precast concrete ring grade adjustment of the frame was placed on top of the gasket material, forming a water-tight seal. (Baker-FRC) W81-01102

8B. Hydraulics

PILOT SCALE EVALUATION OF PHYSICAL-CHEMICAL WASTEWATER TREATMENT SYSTEM FOR COMBINED SEWER OVER-

Pollutech Pollution Advisory Services Ltd., Oakville (Ontario).

ville (Ontario). Environmental Protection Service, Ottawa, Ontar-io, Canada. Canada-Ontario Agreement on Great Lakes Water Quality Research Report No 36, 1976. 96 p, 27 Fig. 29 Tab, 19 Ref.

Descriptors: *Sewerage, *Wastewater treatment *Sewer outfalls, Microstrainers-ozonation system, Stormwater drainage, Dry weather flow, Hydrau-lic loading, *Great Lakes, Water quality, Physicalchemical treatment, *Sewer overflows, Design cri-

This report describes a pilot scale investigation of Ints report describes a pilot scale investigation of the feasibility of using coarse screening, microscreening, and ozonation for the treatment of combined sewer overflows. The pilot scale system consisted of a Crane-Cochran Microstrainer with 23 micron screen openings and an ozone generator. During the first part of the study, the pilot unit was installed at the West Oakville Water Pollution. Control Plant. The dilute waste concentrations anticipated in combined sewer overflows were simulated by diluting raw sewage with tapwater. The contaminants measured were BOD, total organic carbon, suspended solids, total phosphorus, oil and grease, and total coliforms. The effects of on an grease, and total conforms. The effects waste strength and hydraulic loading were studied by varying the dilution of the raw waste and controlling the throughput of the unit. (WATDOC) W81-01020

8G. Materials

MADE TO MEASURE, For primary bibliographic entry see Field 8A. W81-01074

8I. Fisheries Engineering

FISH MANAGEMENT AND PROTECTION Oregon Department of Fish and Wildlife, Port-

In: Conflicts Over the Columbia River, Seminar conducted by Water Resources Research Institute, Oregon State University, Corvallis, Spring Quarter 1980. Report SEMIN WR 028-80, July, 1980, p 29-

Descriptors: *Columbia River, *Fish management, *Fish migration, *Aquatic habitats, *Fish hatcheries, Dams, Spawning, Dam sites, Rainbow trout, Salmonids, Diversion structures, Water management(Applied).

The decline of salmon and steelhead in the Columbia River can be linked with man's industrially based economy, which is in direct competition with the habitat requirements of these fish. Logging and streamside road-building have produced ging and streamside road-outling have produced siltation of spawning beds, low summer stream flows and high temperatures from lack of streamside cover. All reduce the streams' productivity Main-stem dams have blocked large areas of the Columbia and changed it from a free-flowing river to a series of lakes. Problems associated with these dams include a delay in migration due to a slowing of the river, predation as a result of increased exposure time, and residualism wherein the fish will not arrive at the ocean when they are physiologically prepared to and thus remain in the reservoirs. The loss of adults may exceed 20% at some dams with juvenile loss even higher. Resource management agencies are waging a battle to save the fish runs. The logging industry is using buffer strips and restricting road-building along streams as well as using helicopters to log steep areas. Grazing allotments have been reduced on public lands and a few streams have been fenced to pre-vent livestock abuse. Irrigation diversions have been screened to keep downstream migrants from becoming fertilizer for farmer's crops. The Corps of Engineers has also spent millions on bypass systems at main-stem Columbia and Snake River dams. With these and other improvements, the runs can probably survive until hatcheries can be brought into full production over the next 10 to 20 years. (Atkins-Omniplan) W81-01012

WATER QUALITY OF THE COLUMBIA RIVER,

Environmental Protection Agency, Seattle, WA. Water Div For primary bibliographic entry see Field 5C. W81-01200

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

PROGRAM LAYOUT - AN INTERACTIVE PROGRAM TO HANDLE PAGE LAYOUT FOR DOCUMENTATION OF COMPUTER FILES PRINTED ON-LINE AT REMOTE TERMI-NALS, National Hydrology Research Inst., Calgary (Al-

berta). For primary bibliographic entry see Field 7B. W81-01015

10D. Specialized Information Center Services

MANUAL OF PRACTICE ON URBAN DRAIN-

AuE. Environmental Protection Service, Ottawa (Ontar-io). Water Training and Technology Transfer Div. Canada-Ontario Agreement on Great Lakes Water Quality Research Report No 104, 1980. 326 p, 67 Fig, 48 Tab, 71 Ref.

Descriptors: *Urban drainage, *Water quality, *Water pollution effects, *Sewage systems, Drain-age systems, Surface runoff, Flow characteristics, Source controls, Storage facilities, Storm water management, Treatment facilities, Evaluation, Ad-ministration, Controls, Laws, *Great Lakes, Plan-ning, Design criteria, Urban drainage manual.

This manual presents planning and design concepts, analytical and design methodologies, and technological alternatives for prevention and abatement of problems related to the quantity and abatement of problems related to the quantity and quality of storm runoff from developed urban areas and areas undergoing urban development. Solutions to these problems are identified and depend on planning, design, and operation of sanitary, storm, and combine sewage systems. This manual is not a 'design manual' containing the information needed to plan and design urban drainage systems. Rather, it is intended as a presentation of the concepts which can be used to derive solutions to the problems. The manual consolidates the re-search and development findings of the Urban search and development findings of the Urban Drainage Subcommittee program of the Canada-Ontario Agreement as well as information from other Canadian programs and work conducted in other countries, especially the United States, related to storm and combined sewage control. This manual addresses the following specific objectives: To identify the seriousness of urban drainage problems; to identify and describe new effective solutions to urban drainage problems; to present urban drainage problems and solutions in a framework of drainage problems and solutions in a tramework of inter-agency cooperation; to achieve urban storm water management; and to contribute to the achievement of the general and specific water quality objectives for the Great Lakes that have been agreed upon by the governments of Ontario and Canada. (WATDOC) W81-01021

SUBJECT INDEX

Photolysis of 3,4-Dichloroaniline in Natural Waters,	ALGAE Influence of Coal Humic Acid on the Growth of Chlorella Vulgaris Algae,	AQUEOUS SOLUTIONS Chloride Ions in Aqueous Solutions, W81-01049 1B
W81-01101 5A	W81-01009 5C	AQUIFER CHARACTERISTICS
ACID HERBICIDES	Algal Availability of Sediment Phosphorus in	Ground-Water Appraisal of the Fishkill-Beacon
Interlaboratory Quality Control Study No. 24, Analysis of Eight Acid Herbicides in Natural	Drainage Water of the Black Creek Watershed, W81-01058 5B	Area, Dutchess County, New York, W81-01028 2F
Fresh Water, W81-01016 5A	Seasonal and Species-Dependent Variability in	Geology and Ground Water in North-Central
Wol-ololo	the Biological Impact of Mine Wastes in an	Santa Cruz County, California,
ACIDIC WATER Predator-Prey Relations Important for the	Alpine River, W81-01111 5C	W81-01044 7C
Biotic Changes in Acidified Lakes,	ALKALI SOILS	Digital-Simulation and Projection of Head Changes in the Potomac-Raritan-Magothy
W81-01129 5C	Designing Irrigation-Cum-Drainage Ponds for	Aquifer System, Coastal Plain, New Jersey,
ACTIVATED SLUDGE	Alkali Lands, W81-01113 4A	W81-01185 2F
Activated Sludge Wastewater Treatment-Stoi-		D. L
chiometric Relationships, W81-01105 5D	AMMONIA	Development and Use of a Mathematical Model of the San Bernardino Valley Ground-Water
W81-01105 5D	An Automated System for Monitoring the Ki- netics of Biological Oxidation of Ammonia,	Basin, California,
ADAPTATION	W81-01135 5B	W81-01186 2F
Translocation of Mercury and Microbial Adap-	ANADROMOUS FISH	Simulated Effects of a Proposed Well Field on
tation in a Model Aquatic System, W81-01174 5B	The Columbia River: Protein, Power, Preserva-	the Groundwater System in the Salt River
W81-011/4	tion, and Politics,	Indian Reservation, Maricopa County, Arizona,
ADSORPTION	W81-01198 6D	W81-01191 2F
Concentration and Determination of Polycyclic	ANALYTICAL TECHNIQUES	Availability and Quality of Groundwater, South-
Aromatic Hydrocarbons in Aqueous Samples on Graphitized Carbon Black,	Differential Pulse Anodic Stripping Voltam-	ern Ute Indian Reservation, Southwestern Colo-
W81-01068 5A	metry of Copper(II) at the Glassy Carbon Elec-	rado,
TI. T	trode, W81-01010 5A	W81-01197 5B
The Effect of Concentration of Adsorbing Solids on the Partition Coefficient,		AQUIFER SYSTEMS
W81-01144 5B	Interlaboratory Quality Control Study No. 24,	Ground-Water Appraisal of the Fishkill-Beacon
	Analysis of Eight Acid Herbicides in Natural Fresh Water.	Area, Dutchess County, New York,
Interactions and Survival of Enteric Viruses in Soil Materials,	W81-01016 5A	W81-01028 2F
W81-01171 5B	C	AQUIFERS
	Concentration and Determination of Organic Acids in Complex Aqueous Samples,	Simulated Water-Level Declines Near Mar-
AERIAL PHOTOGRAPHY	W81-01067 5A	ienthal, West-Central Kansas,
Aerial Infrared Photography for Flood Plain Investigations,	Application for Trace Chemicals in Water, A	W81-01030 4B
W81-01055 7B	Analyzing for Trace Chemicals in Water: A Manager's Guide,	Geologic Aspects of the Surficial Aquifer in the
	W81-01085 5A	Upper East Coast Planning Area, Southeast
AGRICULTURAL RUNOFF Photolysis of 3,4-Dichloroaniline in Natural	Sediment Oxygen Demand Techniques: A	Florida, W81-01038 4B
Waters,	Review and Comparison of Laboratory and in	W01-01030
W81-01101 5A	Situ Systems,	What to do When the Well Runs Dry,
Designing Irrigation-Cum-Drainage Ponds for	W81-01149 5A	W81-01060 3F
Alkali Lands,	ANION EXCHANGE	ARIZONA
W81-01113 4A	Concentration and Determination of Organic	Simulated Effects of a Proposed Well Field on
AGRICULTURAL WATERSHEDS	Acids in Complex Aqueous Samples, W81-01067 5A	the Groundwater System in the Salt River Indian Reservation, Maricopa County, Arizona,
Changes in Nutrient Ion Level of Substrates and		W81-01191 2F
Stream Water Due to Land Management in	ANNELIDS	
Northumberland,	Relationship of Pollution to Rocky Substratum Polychaetes on the French Mediterranean Coast,	ARKANSAS Water-Quality Investigation of the Caney Creek
W81-01046 5C	W81-01099 5A	Watershed, Northeast Arkansas,
Algal Availability of Sediment Phosphorus in	AQUATIC ENVIRONMENTS	W81-01189 6A
Drainage Water of the Black Creek Watershed,	Some Problems of Aquatic Environments in	AROMATIC COMPOUNDS
W81-01058 5B	Egypt from a General Viewpoint of Nile Ecol-	Concentration and Determination of Polycyclic
ALABAMA	ogy,	Aromatic Hydrocarbons in Aqueous Samples on
Predicting the Effects of Storm Surges and Ab-		Graphitized Carbon Black,
normal River Flow on Flooding and Water Movement in Mobile Bay, Alabama,	AQUATIC HABITATS	W81-01068 5A
W81-01008 2E	Fish Management and Protection,	ARTIFICIAL LAKES
	W81-01012 8I	A Salt Balance Simulation Model of Lake
ALASKA Water-Resources Reconnaissance of the South-	AQUATIC INSECTS	Nasser, W81-01073 2H
eastern Part of St. Paul Island, Pribilof Islands,	Recolonization of Streams by Aquatic Insects Following Channelization,	W 01-010/3
Alaska,	W81-01157 5C	ARTIFICIAL RECHARGE
W81-01033 4A		An Economic Evaluation of the Feasibility of Artificial GroundWater Recharge in Nebraska.
Reconnaissance Snow Survey of the National	AQUATIC LIFE Seasonal and Species-Dependent Variability in	W81-01155 6B
Petroleum Reserve in Alaska, April-May 1979,	the Biological Impact of Mine Wastes in an	
W81-01187 2C	raspine actives;	ASBESTOS FIBRES Asbestos Fibres in Receiving Waters,
ALCOHOLS	W81-01111 5C	W81-01013 5A
Effect of Alcohols on the Mechanical and		
Transport Properties of Asymmetric Cellulose		ASIATIC CLAM Asiatic Clam Invasion: Causes and Effects,
Acetate Membranes, W81-01148 5D	Wales, W81-01131 5C	W81-01173 5C

ASSAY	BIOCHEMICAL OXYGEN DEMAND	CALIFORNIA
Differential Pulse Anodic Stripping Voltam- metry of Copper(II) at the Glassy Carbon Elec-	A Correlation Method for the Estimation of Retention Times at Full-Scale Sewage Treat-	Sediment Transport of Streams Tributary to San Francisco, San Pablo, and Suisun Bays, California, 1909-66,
trode, W81-01010 5A	ment Plants, W81-01150 5D	ma, 1909-06, W81-01034 2J
Direct Potentiometric Water Hardness Determi-	PLODES D. MICH	Geology and Ground Water in North-Central
nation Using Ion-Selective Electrodes, W81-01051 5A	BIODEGRADATION Enhancement of PCBS Biodegradation by Sodium Ligninsulfonate,	Santa Cruz County, California, W81-01044 7C
ATLANTIC OCEAN	W81-01133 5D	Development and Use of a Mathematical Model
Coincidence of Cadmium and Antibiotic Resist-	BIOINDICATORS	of the San Bernardino Valley Ground-Water
ance in New York Bight Apex Benthic Microor- ganisms,	Relationship of Pollution to Rocky Substratum	Basin, California, W81-01186 2F
W81-01116 5B	Polychaetes on the French Mediterranean Coast,	
AUDITS	W81-01099 5A	CANADA Interlaboratory Quality Control Study No. 24,
Management Audits for the 80's,	Taxonomy, Pollution and Sludge Worm,	Analysis of Eight Acid Herbicides in Natural
W81-01098 6E	W81-01117 5A	Fresh Water, W81-01016 5A
AUTOMATION	BIOLOGICAL MEMBRANES	
Automatic Sewage Samplers: What to Look for When Buying.	Residence Time Distribution in Submerged Bio- filters.	International Management of the Columbia, W81-01201 6E
W81-01103 5A	W81-01140 5D	CANAL SEEPAGE
BACTERIA	BIOLOGICAL PROPERTIES	Seepage Study of the West Side and West
Storage-Induced Denitrification Using Sequencing Batch Reactor Operation,	A Statistical Analysis of the Quality of Surface Water in Nebraska,	Canals, Box Elder County, Utah, W81-01026 4A
W81-01132 5D	W81-01180 7C	CANEY CREEK WATERSHED (AR)
Enhancement of PCBS Biodegradation by	BLACK RIVER BASIN (NY)	Water-Quality Investigation of the Caney Creek
Sodium Ligninsulfonate, W81-01133 5D	Development of a Model for Estimating the	Watershed, Northeast Arkansas, W81-01189 6A
	Extent of River Flooding with Satellite and In	
The Thermal Sensitivity of Nitrification as a Function of the Concentration of Nitrogen Sub-	Situ Data, W81-01203 7B	CAPE COD Hypolimnetic Metabolism in Three Cape Cod
strate,		Lakes,
W81-01145 5D	BLACK RIVER (NC) Quality of Water in the Black River Near Dunn,	W81-01128 2H
Translocation of Mercury and Microbial Adap-	North Carolina, and Ground-Water Levels Ad-	CARBOHYDRATES
tation in a Model Aquatic System, W81-01174 5B	jacent to the River Prior to Channel Excavation in 1976-79,	The Monosaccharide Spectra of Natural Waters, W81-01053 2K
	W81-01193 6A	
BASELINE STUDIES Sediment Transport in the Snake and Clearwater	BOREHOLE GEOPHYSICS	CARBON Storage-Induced Denitrification Using Sequenc-
Rivers in the Vicinity of Lewiston, Idaho, W81-01037 2J	Use of Geophysical Logs to Estimate Water-	ing Batch Reactor Operation, W81-01132 5D
	Quality Trends in Carbonate Aquifers, W81-01029 7B	
Water-Quality Investigation of the Caney Creek Watershed, Northeast Arkansas,		CARSON RIVER BASIN (CA-NV) Planning and Design of Studies for River-Qual-
W81-01189 6A	BORON Boron Recovery by Reverse Osmosis,	ity Assessment in the Truckee and Carson River
BASIC DATA COLLECTIONS	W81-01056 5D	Basins, California and Nevada, W81-01024 6A
Water-Quality Monitoring of Three Major Tri-	BOULDER COUNTY (CO)	CHANNEL IMPROVEMENT
butaries to the Chesapeake BayInterim Data Report,	Water Resources of Boulder County, Colorado,	Quality of Water in the Black River Near Dunn,
W81-01184 7C	W81-01031 5B	North Carolina, and Ground-Water Levels Ad- jacent to the River Prior to Channel Excavation
BASINS	BOX ELDER COUNTY (UT)	in 1976-79,
The Truckee Basin Fishery, 1844-1944, W81-01162 5C	Seepage Study of the West Side and West Canals, Box Elder County, Utah,	W81-01193 6A
	W81-01026 4A	CHANNELING
BAYS Sediment Transport of Streams Tributary to San	BRAZIL	Recolonization of Streams by Aquatic Insects
Francisco, San Pablo, and Suisun Bays, Califor-	Hydrologic Investigations in the Araguaia-To-	Following Channelization, W81-01157 5C
nia, 1909-66, W81-01034 2J	cantins River Basin (Brazil),	CHATTAHOOCHEE RIVER (GA)
	W81-01188 7A	An Economic Analysis of Selected Strategies for
BEAR CREEK BASIN (OR) Water Quality of Bear Creek Basin, Jackson	BROMINE	Dissolved-Oxygen Management: Chattahoochee River, Georgia,
County, Oregon,	Chlorine Disappearance in Sea Water, W81-01143 5F	W81-01036 5B
W81-01032 5A		CHEMCIAL OXYGEN DEMAND
BELLA VISTA WATER DISTRICT (CA)	BUFORD DAM (GA) An Economic Analysis of Selected Strategies for	Sediment Oxygen Demand Techniques: A
Low-Cost Filter System Meets Drinking Water Standards.	Dissolved-Oxygen Management: Chattahoochee	Review and Comparison of Laboratory and in Situ Systems,
W81-01084 5F	River, Georgia, W81-01036 5B	W81-01149 5A
BENTHIC FAUNA		CHEMICAL ANALYSIS
Coincidence of Cadmium and Antibiotic Resistance in New York Picht Aper Porthis Misses	CADMIUM Coincidence of Cadmium and Antibiotic Resist-	Differential Pulse Anodic Stripping Voltam-
ance in New York Bight Apex Benthic Microor- ganisms,	ance in New York Bight Apex Benthic Microor-	metry of Copper(II) at the Glassy Carbon Elec- trode,
W81-01116 5B	ganisms, W81-01116 5B	W81-01010 5A
BICARBONATES		Statistical Analyses of Surface-Water-Quality
Effects of Bicarbonate on Sodium Hazard of Irrigation Water: Alternative Formulation,	CALCIUM CHLORIDE Chloride Ions in Aqueous Solutions,	Variables in the Coal Area of Southeastern Mon- tana,
W81-01089 2G	W81-01049 1B	W81-01023 5B

Experimental Assessment of Haloform Reaction	CLIMATIC DATA	CONSTRUCTION
Precursors (Etude d'une Methode d'Evaluation Globale des Precurseurs de la Reaction Halo-	Programs Revap and Wevap for Estimating Areal Evapotranspiration and Lake Evaporation	Made to Measure,
forme),	From Climatological Observations,	W81-01074 8A
W81-01151 5D	W81-01017 2D	CONSTRUCTION MATERIALS
Chemical and Spectroscopic Characterization of	CLOGGING	Made to Measure,
Humic Substances Derived from River Swamps	Asiatic Clam Invasion: Causes and Effects,	W81-01074 8A
in the Flood Plains of Southeastern U.S. Coastal	W81-01173 5C	CONSUMPTIVE USE
Streams,	COATC	Water Usage Patterns in the U.S. Virgin Islands,
W81-01158 5A	COALS Influence of Coal Humic Acid on the Growth of	W81-01005 6D
A Statistical Analysis of the Quality of Surface	Chlorella Vulgaris Algae,	The Columbia River: Protein, Power, Preserva-
Water in Nebraska,	W81-01009 5C	tion, and Politics,
W81-01180 7C	COASTAL PLAIN (NJ)	W81-01198 6D
CHEMICAL DOSAGE CONTROLS	Digital-Simulation and Projection of Head	CONTROLLED DRAINAGE
Chemical Dosage Control for Phosphorus Re-	Changes in the Potomac-Raritan-Magothy	Conservation V. Land Drainage - A Guide for
moval.	Aquifer System, Coastal Plain, New Jersey,	the Future,
W81-01018 5D	W81-01185 2F	W81-01048 6A
CHEMICAL REACTIONS	COASTS	COOLING WATER
An Automated System for Monitoring the Ki-	Relationship of Pollution to Rocky Substratum	Chlorine Disappearance in Sea Water,
netics of Biological Oxidation of Ammonia, W81-01135 5B	Polychaetes on the French Mediterranean Coast,	W81-01143 5F
W81-01133	W81-01099 5A	
CHEMICAL TREATMENT	COKE PLANT EFFLUENTS	COPPER
Report of the Urban Drainage Sub-Committee	Efficiencies of Liquid-Liquid Extraction and	Differential Pulse Anodic Stripping Voltam- metry of Copper(II) at the Glassy Carbon Elec-
Projects Conducted 1972-1978. W81-01019 5D	XAD-4 and XAD-7 Resins in Collecting Organ-	trode,
	ic Compounds from a Coke Plant's Effluent, W81-01112 5A	W81-01010 5A
CHEMICALS	W81-01112	CORDEL ATION ANALYSIS
Coincidence of Cadmium and Antibiotic Resist-	COLOR	CORRELATION ANALYSIS A Correlation Method for the Estimation of
ance in New York Bight Apex Benthic Microor- ganisms,	Colour and Turbidity Removal with Reusable	Retention Times at Full-Scale Sewage Treat-
W81-01116 5B	Magnetic Particles-II. Coagulation with Magnet- ic Polymer Composites,	ment Plants,
	W81-01141 5F	W81-01150 5D
CHESAPEAKE BAY Water-Quality Monitoring of Three Major Tri-		COST ALLOCATION
butaries to the Chesapeake BayInterim Data	COLORADO	Wholesale Water Pricing: A Cost-To-Serve Plan
Report,	Water Resources of Boulder County, Colorado, W81-01031 5B	that Works,
W81-01184 7C		W81-01104 6C
CHLORELLA	Water-Resources Investigations of the U.S. Geo-	COST ANALYSIS
Influence of Coal Humic Acid on the Growth of	logical Survey in ColoradoFiscal Year 1980. W81-01182 7A	An Economic Analysis of Selected Strategies for
Chlorella Vulgaris Algae,	W01-01102	Dissolved-Oxygen Management: Chattahoochee
W81-01009 5C	Availability and Quality of Groundwater, South-	River, Georgia,
CHLORIDES	ern Ute Indian Reservation, Southwestern Colo- rado,	W81-01036 5B
Chloride Ions in Aqueous Solutions,	W81-01197 5B	COST-BENEFIT ANALYSIS
W81-01049 1B		Costs and Benefits of Terraces for Erosion Con-
CHLORINATION	COLUMBIA RIVER Concern Over the Columbia Estuary,	trol,
Experimental Assessment of Haloform Reaction	W81-01011 6E	W81-01062 4D
Precursors (Etude d'une Methode d'Evaluation		Wastewater Treatment Process Evaluated by
Globale des Precurseurs de la Reaction Halo- forme),	Fish Management and Protection, W81-01012 8I	Force Account,
W81-01151 5D	W 61-01012	W81-01086 6B
	The Columbia River: Protein, Power, Preserva-	Agriculture and Hydro-Power: Costs, Benefits,
CHLORINE Chlorine Disappearance in Sea Water,	tion, and Politics,	and Trade-Offs,
W81-01143 5F	W81-01198 6D	W81-01199 6B
	Agriculture and Hydro-Power: Costs, Benefits,	Navigation as an Alternative Use,
CHLOROPHYTA	and Trade-Offs,	W81-01202 6B
Different Methods to Extract Sewage Sludge for the Cultivation of Chlorella Pyrenoidosa,	W81-01199 6B	
W81-01069 5D	Water Quality of the Columbia River,	COST COMPARISONS
	W81-01200 5C	Agriculture and Hydro-Power: Costs, Benefits, and Trade-Offs,
CHROMATOGRAPHY Concentration and Determination of Polycyclic	International Management of the Columbia,	W81-01199 6B
Aromatic Hydrocarbons in Aqueous Samples on	W81-01201 6E	
Graphitized Carbon Black,	No. 1 - al Ala al VI	CROP RESPONSE
W81-01068 5A	Navigation as an Alternative Use, W81-01202 6B	Remotely Sensed Crop Temperature for Water Resources Management,
Determination of the Aqueous Solubilities of		W81-01002 7B
Organic Liquids at 10.0, 20.0, and 30.0 C by	COMPUTER MODELS	
Elution Chromatography,	Programs Revap and Wevap for Estimating Areal Evapotranspiration and Lake Evaporation	Metal Uptake by Crops Grown Over En- trenched Sewage Sludge,
W81-01127 5A	From Climatological Observations,	W81-01100 5E
CLAMS	W81-01017 2D	
Gas Chromatography Combined with Mass	COMPUTER PROGRAMS	Effect of the Salinity of Irrigation Water on
Spectrometry for the Identification of Organic Sulfur Compounds in Shellfish and Fish,	Program Layout - An Interactive Program to	Wheat Yield and Soil Properties, W81-01114 3C
W81-01123 5C	Handle Page Layout for Documentation of	
	Computer Files Printed on-Line at Remote Ter-	Using Saline Water for Crop Production in New
Asiatic Clam Invasion: Causes and Effects, W81-01173 5C	minals, W81-01015 7B	Mexico, W81-01156 3C
W 0 1 4 11 1 / 3	WOL-UIUIO /H	VV (1-1/1130) 31.

CROP TEMPERATURE

CROP TEMPERATURE	DIFFUSIVITY	ECONOMIC FEASIBILITY
Remotely Sensed Crop Temperature for Water Resources Management,	Third-Order Integral Relation Between Sorpti- vity and Soil Water Diffusivity Using Brutsaert's	An Economic Evaluation of the Feasibility of Artificial GroundWater Recharge in Nebraska,
W81-01002 7B	Technique,	W81-01155 6B
CYCLING NUTRIENTS	W81-01076 2G	EFFLUENTS
Sand Cambisol Functioning as a Filter through	A Closed-Form Equation for Predicting the Hy-	Screening at a Fellmongery.
Long-Term Irrigation with Wastewater,	draulic Conductivity of Unsaturated Soils,	W81-01107 5D
W81-01130 5D	W81-01087 2G	Mass Balance,
DAIRY INDUSTRY	DIGESTION	W81-01134 5B
Wastewater Characterization in a Multiproduct	Digester Methane Utilization Can be Optimized,	
Dairy,	W81-01095 5D	Treatment of Dilute Metal Effluents in an Elec-
W81-01170 5F	DAGGER DOES AND A CHIND AND AND AND AND AND AND AND AND AND A	trolytic Precipitator, W81-01172 5D
DELAWARE	DISCHARGE MEASUREMENT	W81-01172 5D
Planning for Fiscal Years 1982/1986.	Mass Balance, W81-01134 5B	EGYPT
W81-01163 6E	W81-01134 5B	A Salt Balance Simulation Model of Lake
	DISSOLVED OXYGEN	Nasser,
DELAWARE RIVER BASIN (PA)	A One-Dimensional, Steady-State, Dissolved-	W81-01073 2H
Water Resources Data for Pennsylvania, Water	Oxygen Model and Waste-load Assimilation	ELECTRIC WELL LOGGING
Year 1979Volume 1. Delaware River Basin.	Study for Little Laughery Creek, Ripley and	
W81-01042 7C	Franklin Counties, Indiana,	Use of Geophysical Logs to Estimate Water- Quality Trends in Carbonate Aquifers,
DENITRIFICATION	W81-01025 5B	W81-01029 7B
Storage-Induced Denitrification Using Sequenc-	An Economic Analysis of Selected Strategies for	W 81-01029
ing Batch Reactor Operation,	Dissolved-Oxygen Management: Chattahoochee	ELECTRODES
W81-01132 5D	River, Georgia,	Direct Potentiometric Water Hardness Determi-
	W81-01036 5B	nation Using Ion-Selective Electrodes,
Residence Time Distribution in Submerged Bio-	W 01-01030	W81-01051 5A
filters,	DISTRIBUTION SYSTEMS	DI DOWN OF PARTS
W81-01140 5D	Anticipate Pipe Freeze-Ups,	Chlorida Jose in Assesse Salutions
DESALINATION	W81-01075 3D	Chloride Ions in Aqueous Solutions, W81-01049
Desalination/Power Cycles with the Biphase	DOCUMENTATION:	W 81-01049
Rotary Separator and Turbine,	DOCUMENTATION Processing Processi	ELECTROPLATING
W81-01165 3A	Program Layout - An Interactive Program to Handle Page Layout for Documentation of	Treatment of Dilute Metal Effluents in an Elec-
	Computer Files Printed on-Line at Remote Ter-	trolytic Precipitator,
Research and Development on a Spiral-Wound	minals,	W81-01172 5D
Membrane System for Single-Stage Seawater Desalination,	W81-01015 7B	ENERGY CONVERSION
W81-01166 3A		Digester Methane Utilization Can be Optimized,
W 01-01100	DOUGLAS COUNTY LAKES (OR)	W81-01095 5D
Research and Development on a Spiral-Wound	Lakes of Oregon: Volume 6. Douglas County,	
Membrane System for Single-Stage Seawater	W81-01043 2H	ENGINEERING
Deslination,	DRAINAGE EFFECTS	Design and Specifications of a 500 Gallon Per
W81-01167 3A	Conservation V. Land Drainage - A Guide for	Day Secondary Refrigerant Freeze Concentra-
DESALINATION PROCESS	the Future,	tion Pilot Plant to Treat Aqueous-Organic In-
Desalination/Power Cycles with the Biphase	W81-01048 6A	dustrial Streams, Phase 1, W81-01006 5D
Rotary Separator and Turbine,		W81-01006 5D
W81-01165 3A	Recolonization of Streams by Aquatic Insects	ENVIRONMENTAL EFFECTS
	Following Channelization,	The Role of Cortisol in Stress-Induced Metabol-
DESALINATION PROCESSES	W81-01157 5C	ic Changes in Fundulus Heteroclitus,
Research and Development on a Spiral-Wound	DRAINAGE ENGINEERING	W81-01007 5C
Membrane System for Single-Stage Seawater Desalination,	Designing Irrigation-Cum-Drainage Ponds for	Lang Torm Effect of Source Studge Additions
W81-01166 3A	Alkali Lands,	Long Term Effect of Sewage Sludge Additions on Populations of Nocardia Asteroides, Micro-
W01-01100	W81-01113 4A	monospora and Thermoactinomyces in Soil,
Research and Development on a Spiral-Wound	DR. 1911 OF BROOK 1155	W81-01061 5C
Membrane System for Single-Stage Seawater	DRAINAGE PROGRAMS	
Deslination,	Conservation V. Land Drainage - A Guide for the Future,	Seasonal and Species-Dependent Variability in
W81-01167 3A		the Biological Impact of Mine Wastes in an
DESIGN CRITERIA	W81-01048 6A	Alpine River, W81-01111 5C
A Well-Head Instrument Package for Multi-Pa-	DRAINAGE SYSTEMS	W81-01111 5C
rameter Measurement during Well Water Sam-	Asbestos Fibres in Receiving Waters,	EOUILIBRIUM
pling,	W81-01013 5A	The Effect of Concentration of Adsorbing
W81-01138 5A	P. P. I. A.	Solids on the Partition Coefficient,
DECICAL DAMA	DRAINAGE WATER	W81-01144 5B
DESIGN DATA	Effects of Bicarbonate on Sodium Hazard of Irrigation Water: Alternative Formulation,	FOURMENT
Made to Measure, W81-01074 8A	W81-01089 2G	EQUIPMENT
W81-01074 8A	11 02-01007	Desalination/Power Cycles with the Biphase Rotary Separator and Turbine,
DETENTION RESERVOIRS	DRYING	W81-01165 3A
Hydraulic Efficiency of Wastewater Lagoon	Sludge Dewatering,	1122,2122
Systems,	W81-01071 5D	EROSION CONTROL
W81-01093 5D	DUTCHESS COLINTY (NY)	Costs and Benefits of Terraces for Erosion Con-
DETERGENTS	DUTCHESS COUNTY (NY) Ground-Water Appraisal of the Fishkill-Beacon	trol,
Response to Comments by A. P. Walker, W. F.	Area, Dutchess County, New York,	W81-01062 4D
Holman and R. H. Wendt,	W81-01028 2F	ESTUARIES
W81-01147 5D		Concern Over the Columbia Estuary,
	EASTERN WASHINGTON	W81-01011 6E
DEWATERING	Water Resources Data for Washington, Water	
Sludge Dewatering, W81-01071 5D	Year 1979Volume 2. Eastern Washington.	Behaviour of Phosphate in Estuarine Water.

Rehabilitation of the Inner Thames Estuary,	FISHERIES	FLOW
W81-01118 5C	The Truckee Basin Fishery, 1844-1944,	Mass Balance,
DI WHODING A WOLL	W81-01162 5C	W81-01134 5B
EUTROPHICATION	FIVE-YEAR PLANS	Analysis of Thomas Import in Tidal Bisses and
Changes in the Zooplankton of Onondaga Lake	Water Problems and Research Needs for Wis-	Analysis of Thermal Impact in Tidal Rivers and Estuaries,
(NY), 1969-1978,	consin, A 5-Year Plan,	W81-01142 5C
W81-01122 5C	W81-01159 6E	W81-01142
The Aquatic Vegetation of Llangorse Lake,		Water Movement Through Stands of Lodgepole
Wales.	Five-Year Water Resources Research and De-	Pine Forest in Wyoming,
W81-01131 5C	velopment Plan, Fiscal Years 1982-1986.	W81-01175 2D
	W81-01160 6E	FLOW NETS
EVALUATION	Planning for Fiscal Years 1982/1986.	Seepage Study of the West Side and West
Reconnaissance Snow Survey of the National	W81-01163 6E	Canals, Box Elder County, Utah,
Petroleum Reserve in Alaska, April-May 1979,		W81-01026 4A
W81-01187 2C	Five-Year Water Resources Research and De-	770
EVAPOTRANSPIRATION	velopment Plan, Fiscal Years 1982-1986,	FLOW RATES
Programs Revap and Wevap for Estimating	W81-01164 6E	Flow Equalize All Influent,
Areal Evapotranspiration and Lake Evaporation	FLASH FLOODS	W81-01119 5D
From Climatological Observations,	Flood of June 18, 1978, on Honey Creek Tribu-	FLOW RESISTANCE
W81-01017 2D	tary at Thornville, Ohio,	Comparative Resistance of the Soil and the Plant
	W81-01194 2E	to Water Transport,
FABRICATION	Trocar i mori	W81-01082 2G
Made to Measure,	FLOCCULATION Colour and Turbidity Remarks with Reveals	
W81-01074 8A	Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnet-	FORECASTING
FARM PONDS	ic Polymer Composites,	Predicting the Effects of Storm Surges and Ab-
Designing Irrigation-Cum-Drainage Ponds for	W81-01141 5F	normal River Flow on Flooding and Water
Alkali Lands,		Movement in Mobile Bay, Alabama,
W81-01113 4A	FLOOD CONTROL	W81-01008 2E
76	Quality of Water in the Black River Near Dunn,	FOREST MANAGEMENT
FILTERS	North Carolina, and Ground-Water Levels Ad-	Irrigation of Intensively Cultured Plantations
Electron Microscopy of Giardia Lamblia Cysts,	jacent to the River Prior to Channel Excavation	with Paper Mill Effluent,
W81-01059 5F	in 1976-79,	W81-01094 3C
	W81-01193 6A	
Residence Time Distribution in Submerged Bio-	FLOOD FORECASTING	FORESTS
filters,	Development of a Model for Estimating the	Litterfall, Stemflow, and Throughfall Nutrient
W81-01140 5D	Extent of River Flooding with Satellite and In	Fluxes in an Alluvial Swamp Forest,
Packed Bed Filtration: Experimental Investiga-	Situ Data,	W81-01065 5B
tion and Conceptual Analysis of Filter Ripening	W81-01203 7B	Water Movement Through Stands of Lodgepole
Model,	ET COD BY ATMO	Pine Forest in Wyoming,
W81-01168 5D	FLOOD PLAINS	W81-01175 2D
	Chemical and Spectroscopic Characterization of Humic Substances Derived from River Swamps	
FILTRATION	in the Flood Plains of Southeastern U.S. Coastal	FRANKLIN COUNTY (IN)
New Concepts for the Treatment of Sewage	Streams,	A One-Dimensional, Steady-State, Dissolved-
Discharged to the Sea,	W81-01158 5A	Oxygen Model and Waste-load Assimilation
W81-01080 5D		Study for Little Laughery Creek, Ripley and
Low-Cost Filter System Meets Drinking Water	FLOOD PROFILES	Franklin Counties, Indiana, W81-01025 5B
Standards,	Aerial Infrared Photography for Flood Plain	W 81-01025 3B
W81-01084 5F	Investigations,	FREEZING
	W81-01055 7B	Design and Specifications of a 500 Gallon Per
Sand Cambisol Functioning as a Filter through	FLOODING	Day Secondary Refrigerant Freeze Concentra-
Long-Term Irrigation with Wastewater,	Predicting the Effects of Storm Surges and Ab-	tion Pilot Plant to Treat Aqueous-Organic In-
W81-01130 5D	normal River Flow on Flooding and Water	dustrial Streams, Phase 1,
Illerafiltentian Processes for Pollution Control	Movement in Mobile Bay, Alabama,	W81-01006 5D
Ultrafiltration Processes for Pollution Control and Chemical Reuse in the Tanning Industry,	W81-01008 2E	Anticipate Dine France I Inc
W81-01139 5D	FLOODS	Anticipate Pipe Freeze-Ups, W81-01075 3D
	FLOODS	30
FISH	Flood of June 18, 1978, on Honey Creek Tribu- tary at Thornville, Ohio,	FRESHWATER
The Role of Cortisol in Stress-Induced Metabol-	W81-01194 2E	Interlaboratory Quality Control Study No. 24,
ic Changes in Fundulus Heteroclitus,	WOL-01174 2E	Analysis of Eight Acid Herbicides in Natural
W81-01007 5C	FLORIDA	Fresh Water,
D. L. & Miles of co. of Abr. To. 1700	Model Evaluation of the Hydrogeology of the	W81-01016 5A
Rehabilitation of the Inner Thames Estuary,	Morris Bridge Well Field and Vicinity in West-	FULVIC ACIDS
W81-01118 5C	Central Florida,	Differential Pulse Anodic Stripping Voltam-
FISH BARRIERS	W81-01027 6A	metry of Copper(II) at the Glassy Carbon Elec-
Offshore Water Intakes Designed to Protect	Geologic Aspects of the Surficial Aquifer in the	trode.
Fish,	Upper East Coast Planning Area, Southeast	W81-01010 5A
W81-01070 6G	Florida.	
	W81-01038 4B	Chemical and Spectroscopic Characterization of
FISH HATCHERIES		Humic Substances Derived from River Swamps
Fish Management and Protection,	FLORIDAN AQUIFER	in the Flood Plains of Southeastern U.S. Coastal
W81-01012 8I	Model Evaluation of the Hydrogeology of the	Streams,
FISH MANAGEMENT	Morris Bridge Well Field and Vicinity in West-	W81-01158 5A
Fish Management and Protection,	Central Florida,	FUNGI
W81-01012 8I	W81-01027 6A	Utilization of the White-Rot Fungus Sporotri-
01	FLOTATION	chum Pulverulentum for Water Purification and
FISH MIGRATION	Advanced Primary Treatment for Ocean Dis-	Protein Production on Mixed Lignocellulosic
Fish Management and Protection,	charge,	Wastewaters,
W81-01012 8I	W81-01079 5D	W81-01126 5D

Digester Methane Utilization Can be Optimized,	W81-01088	5A	eastern Part of St. Paul Island, Pribilof Islands,
W81-01095 5D	Vi		Alaska,
GAS CHROMATOGRAPHY	Viruses in Groundwater, W81-01121	5B	W81-01033 4A
Gas Chromatography Combined with Mass Spectrometry for the Identification of Organic Sulfur Compounds in Shellfish and Fish,	A Well-Head Instrument Package for Multi-	-Pa-	Ground-Water Levels in New Mexico, 1977, W81-01181 7C
W81-01123 5C	rameter Measurement during Well Water St pling,	MIII.	Digital-Simulation and Projection of Head
Enhancement of PCBS Biodegradation by	W81-01138	5A	Changes in the Potomac-Raritan-Magothy Aquifer System, Coastal Plain, New Jersey,
Sodium Ligninsulfonate, W81-01133 5D	Water Resources Data For Washington, Wayear 1979Volume 1. Western Washington.	ater	W81-01185 2F
GEOCHEMISTRY	W81-01176	7C	Water-Quality Investigation of the Caney Creek Watershed, Northeast Arkansas,
Geochemistry of Water in the Fort Union For- mation of the Northern Powder River Basin,	Water Resources Data for Washington, W. Year 1979Volume 2. Eastern Washington.	ater	W81-01189 6A
Southeastern Montana, W81-01041 5B	W81-01177	7C	HARDEMAN COUNTY (TN) Susceptibility of the Memphis Water Supply to
GEOLOGY Geologic Aspects of the Surficial Aquifer in the	Water Resources Data for Missouri, Water 1979.	Year	Contamination from the Pesticide Waste Dispos- al Site in Northeastern Hardeman County, Ten-
Upper East Coast Planning Area, Southeast Florida.	W81-01178	7C	nessee, W81-01192 5B
W81-01038 4B	Water Resources Data for West Virginia, W Year 1979.	ater	HARDNESS (WATER) Direct Potentiometric Water Hardness Determi-
GEORGIA	W81-01179	7C	nation Using Ion-Selective Electrodes,
An Economic Analysis of Selected Strategies for Dissolved-Oxygen Management: Chattahoochee	Water-Resources Investigations of the U.S. C		W81-01051 5A
River, Georgia, W81-01036 5B	logical Survey in ColoradoFiscal Year 1 W81-01182	1980. 7A	Corrosiveness of Drinking Water and Cardio- vascular Disease Mortality,
GLENDALE (CA)	Simulated Effects of a Proposed Well Field	d on	W81-01109 5F
Los Angeles, Glendale Share Reuse Plant's Pro-	the Groundwater System in the Salt R	River	HAWAII
visions, W81-01096 5D	Indian Reservation, Maricopa County, Ariz W81-01191	zona, 2F	Test Monitoring of Prototype Injection Well, Waiale, Maui, Hawaii,
GREAT BRITAIN	Approximate Altitude of Water Levels in V	Wells	W81-01190 6A
The Aquatic Vegetation of Llangorse Lake, Wales,	in the Chicot and Evangeline Aquifers in Houston Area, Texas, Spring 1979 and Sp		HEAVY METALS Effects of Heavy Metals in Combination with
W81-01131 5C	1980, W81-01196	2F	NTA, Humic Acid, and Suspended Sediment on Natural Phytoplankton Photosynthesis,
GREAT LAKES Chemical Dosage Control for Phosphorus Re-	GROUNDWATER ALLOCATION (POLICY)		W81-01108 5C
moval. W81-01018 5D	Water Resources Research Coordination Planning in the Missouri River Basin.		Comment, W81-01146 5D
Report of the Urban Drainage Sub-Committee	W81-01003	6B	HERBICIDES
Projects Conducted 1972-1978. W81-01019 5D	GROUNDWATER AVAILABILITY		Photolysis of 3,4-Dichloroaniline in Natural Waters,
Pilot Scale Evaluation of Physical-Chemical	Ground-Water Appraisal of the Fishkill-Be Area, Dutchess County, New York,	eacon	W81-01101 5A
Wastewater Treatment System for Combined Sewer Overflows.	W81-01028	2F	HISTORY The Orr Ditch Case, 1913-1944,
W81-01020 8B	Geology and Ground Water in North-Co	entral	W81-01161 6E
Manual of Practice on Urban Drainage. W81-01021 10D	Santa Cruz County, California, W81-01044	7C	The Truckee Basin Fishery, 1844-1944, W81-01162 5C
GROUNDWATER	Availability and Quality of Groundwater, S		HONEY CREEK TRIBUTARY (OH)
Simulated Water-Level Declines Near Mar- ienthal, West-Central Kansas,	ern Ute Indian Reservation, Southwestern rado,	Colo-	Flood of June 18, 1978, on Honey Creek Tribu-
W81-01030 4B	W81-01197	5B	tary at Thornville, Ohio, W81-01194 2E
Water Resources of Boulder County, Colorado, W81-01031 5B	GROUNDWATER BASINS Development and Use of a Mathematical M	Model	HONOLULU
Geologic Aspects of the Surficial Aquifer in the	of the San Bernardino Valley Ground-V Basin, California,		Advanced Primary Treatment for Ocean Dis- charge,
Upper East Coast Planning Area, Southeast Florida,	W81-01186	2F	W81-01079 5D
W81-01038 4B	GROUNDWATER POTENTIAL		HOUSTON AREA (TX) Approximate Altitude of Water Levels in Wells
Water Resources Data for Montana, Water Year 1979.	Geology and Ground Water in North-Co Santa Cruz County, California,		in the Chicot and Evangeline Aquifers in the Houston Area, Texas, Spring 1979 and Spring
W81-01039 7C	W81-01044	7C	1980,
Water Resources Data for Puerto Rico, Water	GROUNDWATER RECHARGE An Economic Evaluation of the Feasibil	lity of	W81-01196 2F
Year 1977. Surface and Quality-of-Water Records and Ground Water Records.	Artificial GroundWater Recharge in Neb W81-01155		HUMAN DISEASES Corrosiveness of Drinking Water and Cardio-
W81-01040 7C	GROUNDWATER RESOURCES	UD.	vascular Disease Mortality, W81-01109 5F
Geochemistry of Water in the Fort Union For- mation of the Northern Powder River Basin.	Water Resources Research Coordination	n and	HUMIC ACIDS
Southeastern Montana,	Planning in the Missouri River Basin. W81-01003	6B	Influence of Coal Humic Acid on the Growth of
W81-01041 5B			Chlorella Vulgaris Algae, W81-01009 5C
Water Resources Data for Pennsylvania, Water Year 1979Volume 1. Delaware River Basin.	Ground-Water Appraisal of the Fishkill-B Area, Dutchess County, New York,	Beacon	Chemical and Spectroscopic Characterization of
W81-01042 7C	W81-01028	2F	Humic Substances Derived from River Swamps

in the Flood Plains of Southeastern U.S. Coastal	HYPERION PLANT	INJECTION WELLS
Streams,	Los Angeles to Meet Regs with Energy-Miser	Saturated-Unsaturated Flow in Radial Direc-
W81-01158 5A	Sludge Processor, W81-01152 5D	tions Generated by an Injection Well, W81-01091 2G
HYDRAULIC CONDUCTIVITY	W81-01132	W 61-01071
A Closed-Form Equation for Predicting the Hy-	HYPOLIMNION	Test Monitoring of Prototype Injection Well,
draulic Conductivity of Unsaturated Soils,	Hypolimnetic Metabolism in Three Cape Cod	Waiale, Maui, Hawaii, W81-01190 6A
W81-01087 2G	Lakes, W81-01128 2H	W 61-01170
Comparison of One-Step Outflow Laboratory		INTAKES
Method to an in Situ Method for Measuring	IDAHO	Asiatic Clam Invasion: Causes and Effects, W81-01173 5C
Hydraulic Conductivity,	Sediment Transport in the Snake and Clearwater	W61-011/3
W81-01092 2G	Rivers in the Vicinity of Lewiston, Idaho, W81-01037 2J	INTERNATIONAL WATERS
HYDRAULIC STRUCTURES	W 01-01037	International Management of the Columbia,
Offshore Water Intakes Designed to Protect	IMAGE ANALYSIS	W81-01201 6E
Fish, W81-01070 6G	Development of a Model for Estimating the	INVERTEBRATES
	Extent of River Flooding with Satellite and In Situ Data.	Detrital Processing and Associated Macroinver- tebrates in a Colorado Mountain Stream,
HYDROELECTRIC PLANTS	W81-01203 7B	W81-01066 5B
Water Quality of the Columbia River,		
W81-01200 5C	IMPAIRED WATER USE Using Saline Water for Crop Production in New	INVESTIGATIONS
HYDROELECTRIC POWER	Mexico,	Lakes of Oregon: Volume 6. Douglas County, W81-01043 2H
The Columbia River: Protein, Power, Preserva-	W81-01156 3C	
tion, and Politics, W81-01198 6D	TANDYANIA	IRON COMPOUNDS
W61-01196	INDIANA A One-Dimensional, Steady-State, Dissolved-	Behaviour of Phosphate in Estuarine Water, W81-01050 5B
Agriculture and Hydro-Power: Costs, Benefits,	Oxygen Model and Waste-load Assimilation	W81-01030
and Trade-Offs,	Study for Little Laughery Creek, Ripley and	IRON OXIDES
W81-01199 6B	Franklin Counties, Indiana,	Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnet-
HYDROELECTRIC POWER PLANTS	W81-01025 5B	ic Polymer Composites,
The Columbia River: Protein, Power, Preserva-	Water-Quality Assessment of the Porter County	W81-01141 5F
tion, and Politics, W81-01198 6D	Watershed, Kankakee River Basin, Porter	
W81-01198 6D	County, Indiana,	IRRIGATION Application of Sewage Effluent to Columns of a
HYDROGEOLOGY	W81-01035 5B	Mountain Meadow Soil: I. Errors in Calculating
Model Evaluation of the Hydrogeology of the	INDUSTRIAL WASTES	the Transport of Ionic Salts,
Morris Bridge Well Field and Vicinity in West- Central Florida.	Plating Waste Treatment,	W81-01090 3C
W81-01027 6A	W81-01057 5D	Irrigation of Intensively Cultured Plantations
	Screening at a Fellmongery.	with Paper Mill Effluent,
Digital-Simulation and Projection of Head Changes in the Potomac-Raritan-Magothy	W81-01107 5D	W81-01094 3C
Aquifer System, Coastal Plain, New Jersey,	Utilization of the White-Rot Fungus Sporotri-	The Columbia River: Protein, Power, Preserva-
W81-01185 2F	chum Pulverulentum for Water Purification and	tion, and Politics,
INTROLOGIC DATA	Protein Production on Mixed Lignocellulosic	W81-01198 6D
HYDROLOGIC DATA Seepage Study of the West Side and West	Wastewaters,	IRRIGATION CANALS
Canals, Box Elder County, Utah,	W81-01126 5D	Water Quality of Bear Creek Basin, Jackson
W81-01026 4A	Ultrafiltration Processes for Pollution Control	County, Oregon,
Water Resources Data for Montana, Water Year	and Chemical Reuse in the Tanning Industry,	W81-01032 5A
1979.	W81-01139 5D	IRRIGATION PROGRAMS
W81-01039 7C	Wastewater Characterization in a Multiproduct	Agriculture and Hydro-Power: Costs, Benefits,
Water Barrers Date for Breats Bire Water	Dairy,	and Trade-Offs,
Water Resources Data for Puerto Rico, Water Year 1977. Surface and Quality-of-Water Re-	W81-01170 5F	W81-01199 6B
cords and Ground Water Records.	Treatment of Dilute Metal Effluents in an Elec-	IRRIGATION SYSTEMS
W81-01040 7C	trolytic Precipitator,	What to do When the Well Runs Dry,
Water Resources Data for Pennsylvania, Water	W81-01172 5D	W81-01060 3F
Year 1979Volume 1. Delaware River Basin.	VALUE OF THE ACT OF TH	IRRIGATION WATER
W81-01042 7C	INDUSTRIAL WATER Wastewater Characterization in a Multiproduct	A Salt Balance Simulation Model of Lake
Labor of Ocean Values 6 Develor Country	Dairy,	Nasser,
Lakes of Oregon: Volume 6. Douglas County, W81-01043 2H	W81-01170 5F	W81-01073 2H
	INFLOW	Effects of Bicarbonate on Sodium Hazard of
Water Resources Data For Washington, Water	Flow Equalize All Influent,	Irrigation Water: Alternative Formulation,
Year 1979Volume 1. Western Washington. W81-01176 7C	W81-01119 SD	W81-01089 2G
W81-01176 7C		Effect of the Salinity of Irrigation Water on
Water Resources Data for Washington, Water	INFORMATION RETRIEVAL Fiscal 1980 Annual Report to Office of Water	Wheat Yield and Soil Properties,
Year 1979Volume 2. Eastern Washington.	December of Technology UCDI	W81-01114 3C
W81-01177 7C	W81-01004 6E	An Economic Evaluation of the Feasibility of
Water Resources Data for Missouri, Water Year	Decement Laurent An Internation Decement	Artificial GroundWater Recharge in Nebraska,
1979.	Program Layout - An Interactive Program to Handle Page Layout for Documentation of	
W81-01178 7C	Computer Files Printed on-Line at Remote Ter-	JACKSON COUNTY (OR)
Water Resources Data for West Virginia, Water	minals,	Water Quality of Bear Creek Basin, Jackson
Year 1979.	W81-01015 7B	County, Oregon,
W81-01179 7C	INFRARED RADIATION	W81-01032 5A
HYDROLOGIC EQUATION	Aerial Infrared Photography for Flood Plain	JUDICIAL DECISION
Mass Balance,	Investigations,	The Orr Ditch Case, 1913-1944,
W81-01134 5B	W81-01055 7B	W81-01161 6E

SUBJECT INDEX

KANKAKEE RIVER BASIN

KANKAKEE RIVER BASIN	The Aquatic Vegetation of Llangorse Lake,	Houston Area, Texas, Spring 1979 and Spring
Water-Quality Assessment of the Porter County	Wales, W81-01131 5C	1980, W81-01196 2F
Watershed, Kankakee River Basin, Porter	W81-01131 5C	W81-01190 2F
County, Indiana, W81-01035 5B	LAND MANAGEMENT Conservation V. Land Drainage - A Guide for	MARICOPA COUNTY (AZ) Simulated Effects of a Proposed Well Field on
KANSAS	the Future,	the Groundwater System in the Salt River
Simulated Water-Level Declines Near Mar-	W81-01048 6A	Indian Reservation, Maricopa County, Arizona,
ienthal, West-Central Kansas,	I ARTE LICE	W81-01191 2F
W81-01030 4B	LAND USE Input into and Fate of Lead in a Small Reser-	MASS SPECTROMETRY
What to do When the Well Runs Dry,	voir,	Gas Chromatography Combined with Mass Spectrometry for the Identification of Organic
W81-01060 3F	W81-01045 5B	Sulfur Compounds in Shellfish and Fish,
Maps Showing Saturated Thickness, January	Land Use. Pigs in Pokes: Pork Barrel Water Projects.	W81-01123 5C
1979, and Percentage Decrease in Saturated Thickness, 1950-79, of Unconsolidated Aquifer,	W81-01063 5C	MATERIALS ENGINEERING Made to Measure,
West-Central, Kansas,	LANDSAT	W81-01074 8A
W81-01195 7C	Development of a Model for Estimating the	
KINETICS	Extent of River Flooding with Satellite and In	MATHEMATICAL MODELS Activated Sludge Wastewater TreatmentStoi-
Evaluation of Steady-State-Biofilm Kinetics,	Situ Data,	chiometric Relationships,
W81-01125 5A	W81-01203 7B	W81-01105 5D
	LEAD	De de la constant de Malana de la Malana
Kinetics of Trace Metal Partitioning in Model	Input into and Fate of Lead in a Small Reser-	Development and Use of a Mathematical Model of the San Bernardino Valley Ground-Water
Anoxic Marine Sediments,	voir,	Basin, California,
W81-01154 5B	W81-01045 5B	W81-01186 2F
LABORATORY TESTS	LEAVES	
Interlaboratory Quality Control Study No. 24,	Detrital Processing and Associated Macroinver-	MATHEMATICAL STUDIES The Effect of Concentration of Adecahing
Analysis of Eight Acid Herbicides in Natural	tebrates in a Colorado Mountain Stream,	The Effect of Concentration of Adsorbing Solids on the Partition Coefficient,
Fresh Water,	W81-01066 5B	W81-01144 5B
W81-01016 5A	LEGAL ASPECTS	
The Effect of Concentration of Adsorbing	The Truckee Basin Fishery, 1844-1944,	The Thermal Sensitivity of Nitrification as a
Solids on the Partition Coefficient,	W81-01162 5C	Function of the Concentration of Nitrogen Sub- strate.
W81-01144 5B	LEGISLATION	W81-01145 5D
Comment,	Philosophy of the Safe Drinking Water Act and	
W81-01146 5D	Potable Reuse,	MAUI (HI) Test Monitoring of Prototype Injection Well,
	W81-01120 5D	Waiale, Maui, Hawaii,
Response to Comments by A. P. Walker, W. F.	LIGHT PENETRATION	W81-01190 6A
Holman and R. H. Wendt, W81-01147 5D	Hypolimnetic Metabolism in Three Cape Cod	ME ACCIDENCENT
W01-01147	Lakes,	MEASUREMENT In-Situ Registration of Oxygen Utilization at
Kinetics of Trace Metal Partitioning in Model	W81-01128 2H	Sediment-Water Interfaces,
Anoxic Marine Sediments,	LODGEPOLE PINE TREES	W81-01054 2K
W81-01154 5B	Water Movement Through Stands of Lodgepole	MEMBRANE PROCESSES
LAGOONS	Pine Forest in Wyoming,	Effect of Alcohols on the Mechanical and
Hydraulic Efficiency of Wastewater Lagoon	W81-01175 2D	Transport Properties of Asymmetric Cellulose
Systems,	LOGGING (RECORDING)	Acetate Membranes,
W81-01093 5D	Use of Geophysical Logs to Estimate Water-	W81-01148 5D
LAKE EVAPORATION	Quality Trends in Carbonate Aquifers,	MEMBRANES
Programs Revap and Wevap for Estimating	W81-01029 7B	Development of Novel Porous Substrates for
Areal Evapotranspiration and Lake Evaporation	LOS ANGELES	Ultrafiltration, Desalination, and Water Recla
From Climatological Observations,	Los Angeles, Glendale Share Reuse Plant's Pro-	mation,
W81-01017 2D	visions,	W81-01001 3A
LAKE NASSER	W81-01096 5D	Research and Development on a Spiral-Wound
A Salt Balance Simulation Model of Lake	Los Angeles to Meet Regs with Energy-Miser	Membrane System for Single-Stage Seawate
Nasser,	Sludge Processor,	Desalination, W81-01166 3A
W81-01073 2H	W81-01152 5D	W 01-U1100 3.P
LAKE SEDIMENTS		Research and Development on a Spiral-Wound
A Reaction Chamber for Study of Interactions	MAINTENANCE New Ways to Fix Leaky Sewers.	Membrane System for Single-Stage Seawate
between Sediments and Water under Conditions	W81-01102 8A	Deslination,
of Static or Continuous Flow,		W81-01167 3A
W81-01137 5B	MANAGEMENT	MERCURY
LAKES	Effective Wastewater Management Planning for	Measurement of Mercury Methylation in Lak
Lakes of Oregon: Volume 6. Douglas County,	Small Communities - Part 2, W81-01083 6E	Water and Sediment Samples, W81-01047
W81-01043 2H		W81-01047 5A
Land Lice Piec in Poles. Dock Postal Water	Management Audits for the 80's,	Variability and Loading of Mercury in a Small
Land Use. Pigs in Pokes: Pork Barrel Water Projects.	W81-01098 6E	Prairie River,
W81-01063 5C	MAPS	. W81-01110 51
	Maps Showing Saturated Thickness, January	Translocation of Mercury and Microbial Adap
Changes in the Zooplankton of Onondaga Lake	1979, and Percentage Decrease in Saturated	tation in a Model Aquatic System,
(NY), 1969-1978, W81-01122 5C	Thickness, 1950-79, of Unconsolidated Aquifer,	W81-01174 5
W81-01122 5C	West-Central, Kansas, W81-01195 7C	METABOLISM
Predator-Prey Relations Important for the	70	The Role of Cortisol in Stress-Induced Metabo
Biotic Changes in Acidified Lakes, W81-01129	Approximate Altitude of Water Levels in Wells	ic Changes in Fundulus Heteroclitus,
W81-01129 5C	in the Chicot and Evangeline Aquifage in the	W81_01007 5

METALS	Model Evaluation of the Hydrogeology of the	MULTIPLE-PURPOSE RESERVOIRS
Plating Waste Treatment, W81-01057 5D	Morris Bridge Well Field and Vicinity in West- Central Florida,	Design of Objective Functions for Reservoir Operations,
Analyzing for Trace Chemicals in Water: A	W81-01027 6A	W81-01169 6B
Manager's Guide, W81-01085 5A	Simulated Water-Level Declines Near Mar- ienthal, West-Central Kansas,	MULTISPECTRAL SCANNER DATA Development of a Model for Estimating the
74	W81-01030 4B	Extent of River Flooding with Satellite and In
Metal Uptake by Crops Grown Over En- trenched Sewage Sludge,	A Salt Balance Simulation Model of Lake	Situ Data, W81-01203 7B
W81-01100 5E	Nasser,	
Effects of Heavy Metals in Combination with	W81-01073 2H	MUNICIPAL WASTES Water-Quality Assessment of the Porter County
NTA, Humic Acid, and Suspended Sediment on Natural Phytoplankton Photosynthesis,	Activated Sludge Wastewater TreatmentStoi- chiometric Relationships,	Watershed, Kankakee River Basin, Porter County, Indiana,
W81-01108 5C	W81-01105 5D	W81-01035 5B
Kinetics of Trace Metal Partitioning in Model	Mass Balance,	Advanced Primary Treatment for Ocean Dis-
Anoxic Marine Sediments, W81-01154 5B	W81-01134 5B	charge, W81-01079 5D
	Residence Time Distribution in Submerged Bio-	
Treatment of Dilute Metal Effluents in an Elec- trolytic Precipitator,	filters,	New Concepts for the Treatment of Sewage Discharged to the Sea,
W81-01172 5D	W81-01140 5D	W81-01080 5D
METHODOLOGY	Analysis of Thermal Impact in Tidal Rivers and Estuaries.	Improved Wastewater Treatment for Holiday
A Reaction Chamber for Study of Interactions between Sediments and Water under Conditions	W81-01142 5C	Resort Towns on the Coast, W81-01081 5D
of Static or Continuous Flow,	Madeline the Burnell Brosses in Liches Acces	W01-01001
W81-01137 5B	Modeling the Runoff Process in Urban Areas, W81-01153 2A	Wastewater Treatment Process Evaluated by Force Account,
MICROORGANISMS	Disiral Cincologica and Burianian and War	W81-01086 6B
Measurement of Mercury Methylation in Lake	Digital-Simulation and Projection of Head Changes in the Potomac-Raritan-Magothy	
Water and Sediment Samples, W81-01047 5A	Aquifer System, Coastal Plain, New Jersey,	Application of Sewage Effluent to Columns of a Mountain Meadow Soil: I. Errors in Calculating
	W81-01185 2F	the Transport of Ionic Salts, W81-01090 3C
Coincidence of Cadmium and Antibiotic Resist- ance in New York Bight Apex Benthic Microor-	Development and Use of a Mathematical Model	
ganisms,	of the San Bernardino Valley Ground-Water Basin, California,	MUSSELS
W81-01116 5B	W81-01186 2F	Mussels (Mytilus Edulis) as 'Point Source' Indi- cators of Trace Metal Pollution,
Psychrophiles, Psychrotrophs, and Mesophiles	Simulated Effects of a Proposed Well Field on	W81-01115 5A
in an Environment which Experiences Seasonal Temperature Fluctuations,	the Groundwater System in the Salt River Indian Reservation, Maricopa County, Arizona,	NATIONAL PETROLEUM RESERVE IN ALASKA
W81-01124 5A	W81-01191 2F	Reconnaissance Snow Survey of the National
Evaluation of Steady-State-Biofilm Kinetics, W81-01125 5A	Development of a Model for Estimating the Extent of River Flooding with Satellite and In	Petroleum Reserve in Alaska, April-May 1979, W81-01187 2C
MINE ACIDS	Situ Data,	NATURAL RESOURCES
Influence of Coal Humic Acid on the Growth of	W81-01203 7B	U.S. Geological Survey Activities in New York,
Chlorella Vulgaris Algae,	MONITORING	1979. W81-01183 7A
W81-01009 5C	Test Monitoring of Prototype Injection Well,	
MINE WASTES	Waiale, Maui, Hawaii,	NATURAL STREAMS
Seasonal and Species-Dependent Variability in the Biological Impact of Mine Wastes in an	W81-01190 6A	The Monosaccharide Spectra of Natural Waters, W81-01053 2K
Alpine River,	MONITORING PROCEDURES	Detrital Processing and Associated Macroinver-
W81-01111 5C	Chemical Dosage Control for Phosphorus Re- moval.	tebrates in a Colorado Mountain Stream,
MISSOURI	W81-01018 5D	W81-01066 5B
Water Resources Data for Missouri, Water Year	MONTANA	NAVIGATION
1979. W81-01178 7C	Statistical Analyses of Surface-Water-Quality	Navigation as an Alternative Use, W81-01202 6B
MICCOURT DIVER BACIN	Variables in the Coal Area of Southeastern Mon-	
MISSOURI RIVER BASIN Water Resources Research Coordination and	tana, W81-01023 5B	NEBRASKA An Economic Evaluation of the Feasibility of
Planning in the Missouri River Basin. W81-01003 6B	Water Resources Data for Montana, Water Year	Artificial GroundWater Recharge in Nebraska,
	1979.	W81-01155 6B
MOBILE BAY (AL) Predicting the Effects of Storm Surges and Ab-	W81-01039 7C	A Statistical Analysis of the Quality of Surface
normal River Flow on Flooding and Water	Geochemistry of Water in the Fort Union For- mation of the Northern Powder River Basin,	Water in Nebraska, W81-01180 7C
Movement in Mobile Bay, Alabama, W81-01008 2E	Southeastern Montana,	NETWORKS
MODEL CTUDIES	W81-01041 5B	Hydrologic Investigations in the Araguaia-To-
MODEL STUDIES Predicting the Effects of Storm Surges and Ab-	MOOSE JAW RIVER (SASKATCHEWAN)	cantins River Basin (Brazil), W81-01188 7A
normal River Flow on Flooding and Water	Variability and Loading of Mercury in a Small	
Movement in Mobile Bay, Alabama, W81-01008 2E	Prairie River, W81-01110 5B	NEVADA The Truckee Basin Fishery, 1844-1944,
A One-Dimensional, Steady-State, Dissolved-	MORRIS BRIDGE WELL FIELD	W81-01162 5C
Oxygen Model and Waste-load Assimilation	Model Evaluation of the Hydrogeology of the	NEW JERSEY
Study for Little Laughery Creek, Ripley and	Morris Bridge Well Field and Vicinity in West-	Five-Year Water Resources Research and Development Plan, Fiscal Years 1982-1986.
Franklin Counties, Indiana, W81-01025 5B	Central Florida, W81-01027 6A	W81-01160 6E
31023		

NEW JERSEY

Digital-Simulation and Projection of Head Changes in the Potomac-Raritan-Magothy Aquifer System, Coastal Plain, New Jersey, W81-01185 2F	OHIO Five-Year Water Resources Research and Development Plan, Fiscal Years 1982-1986, W81-01164 6E	An Automated System for Monitoring the Kinetics of Biological Oxidation of Ammonia, W81-01135 5B
W81-01185 2F NEW MEXICO	Flood of June 18, 1978, on Honey Creek Tribu-	The Thermal Sensitivity of Nitrification as a Function of the Concentration of Nitrogen Sub-
Using Saline Water for Crop Production in New Mexico,	tary at Thornville, Ohio, W81-01194 2E	strate, W81-01145 5D
W81-01156 3C	OIL	OXYGEN DEMAND
Ground-Water Levels in New Mexico, 1977, W81-01181 7C	Gas Chromatography Combined with Mass Spectrometry for the Identification of Organic	In-Situ Registration of Oxygen Utilization at Sediment-Water Interfaces,
NEW YORK	Sulfur Compounds in Shellfish and Fish, W81-01123 5C	W81-01054 2K
Ground-Water Appraisal of the Fishkill-Beacon	W 61-01123	OXYGEN REQUIREMENTS
Area, Dutchess County, New York,	OLIGOCHAETES	Improved Wastewater Treatment for Holiday
W81-01028 2F	Taxonomy, Pollution and Sludge Worm, W81-01117 5A	Resort Towns on the Coast, W81-01081 5D
U.S. Geological Survey Activities in New York,		
1979.	ON-SITE INVESTIGATIONS Comment,	PASSIOURA METHOD
W81-01183 7A	W81-01146 5D	Comparison of One-Step Outflow Laboratory Method to an in Situ Method for Measuring
NEW YORK BIGHT APEX	Response to Comments by A. P. Walker, W. F.	Hydraulic Conductivity,
Coincidence of Cadmium and Antibiotic Resist- ance in New York Bight Apex Benthic Microor-	Holman and R. H. Wendt,	W81-01092 2G
ganisms,	W81-01147 5D	PATH OF POLLUTANTS
W81-01116 5B	ON-SITE LABORATORIES	St. Lawrence River Water Quality Surveys,
NILE RIVER	Sediment Oxygen Demand Techniques: A	1977, W81-01014 5B
Some Problems of Aquatic Environments in	Review and Comparison of Laboratory and in Situ Systems,	
Egypt from a General Viewpoint of Nile Ecol-	W81-01149 5A	PENNSYLVANIA Fiscal 1980 Annual Report to Office of Water
ogy, W81-01072 5C		Research and Technology, USDI.
	OPTIMUM DEVELOPMENT PLANS Design of Objective Functions for Reservoir	W81-01004 6E
NITRIFICATION	Operations,	Water Resources Data for Pennsylvania, Water
An Automated System for Monitoring the Ki- netics of Biological Oxidation of Ammonia,	W81-01169 6B	Year 1979Volume 1. Delaware River Basin.
W81-01135 5B	OREGON	W81-01042 7C
The Thermal Sensitivity of Nitrification as a	Water Quality of Bear Creek Basin, Jackson	PESTICIDE RESIDUES
Function of the Concentration of Nitrogen Sub-	County, Oregon, W81-01032 5A	Interlaboratory Quality Control Study No. 24, Analysis of Eight Acid Herbicides in Natural
strate, W81-01145 5D	Lakes of Oregon: Volume 6. Douglas County,	Fresh Water,
	W81-01043 2H	W81-01016 5A
NORTH CAROLINA Quality of Water in the Black River Near Dunn,		PESTICIDES
North Carolina, and Ground-Water Levels Adjacent to the River Prior to Channel Excavation in 1976-79,	ORGANIC ACIDS Design and Specifications of a 500 Gallon Per Day Secondary Refrigerant Freeze Concentra-	Susceptibility of the Memphis Water Supply to Contamination from the Pesticide Waste Dispos- al Site in Northeastern Hardeman County, Ten-
W81-01193 6A	tion Pilot Plant to Treat Aqueous-Organic In- dustrial Streams, Phase 1,	nessee.
NORTH DOWNER BIVER BACIN (ACT)	W81-01006 5D	W81-01192 5B
NORTH POWDER RIVER BASIN (MT) Geochemistry of Water in the Fort Union For-	OBCANIC COMPOUNDS	PHOSPHATES
mation of the Northern Powder River Basin,	ORGANIC COMPOUNDS Efficiencies of Liquid-Liquid Extraction and	Behaviour of Phosphate in Estuarine Water,
Southeastern Montana,	XAD-4 and XAD-7 Resins in Collecting Organ-	W81-01050 5B
W81-01041 5B	ic Compounds from a Coke Plant's Effluent,	PHOSPHORUS
NORTHEAST ARKANSAS	W81-01112 5A	Algal Availability of Sediment Phosphorus in
Water-Quality Investigation of the Caney Creek	Determination of the Aqueous Solubilities of	Drainage Water of the Black Creek Watershed,
Watershed, Northeast Arkansas, W81-01189 6A	Organic Liquids at 10.0, 20.0, and 30.0 C by	W81-01058 5B
	Elution Chromatography, W81-01127 5A	PHOSPHORUS REMOVAL
NUCLEAR REACTORS Boron Recovery by Reverse Osmosis,		Chemical Dosage Control for Phosphorus Re- moval.
W81-01056 5D	Storage-Induced Denitrification Using Sequencing Batch Reactor Operation,	W81-01018 5D
NUTRIENTS	W81-01132 5D	Report of the Urban Drainage Sub-Committee
Changes in Nutrient Ion Level of Substrates and	ORGANIC LOADING	Projects Conducted 1972-1978.
Stream Water Due to Land Management in	A Reaction Chamber for Study of Interactions	W81-01019 5D
Northumberland,	between Sediments and Water under Conditions	PHOTOLYSIS
W81-01046 5C	of Static or Continuous Flow, W81-01137 5B	Photolysis of 3,4-Dichloroaniline in Natural
Litterfall, Stemflow, and Throughfall Nutrient		Waters,
Fluxes in an Alluvial Swamp Forest,	ORGANIC MATTER	W81-01101 5A
W81-01065 5B	Evaluation of Steady-State-Biofilm Kinetics, W81-01125 5A	PHOTOSYNTHESIS
OBSERVATION WELLS		Hypolimnetic Metabolism in Three Cape Cod
Ground-Water Levels in New Mexico, 1977, W81-01181 7C	OUTFALL SEWERS Mussels (Mytilus Edulis) as 'Point Source' Indi-	Lakes, W81-01128 2H
	cators of Trace Metal Pollution,	
OGALLALA FORMATION Maps Showing Saturated Thickness, January	W81-01115 5A	PILOT PLANTS Design and Specifications of a 500 Gallon Per
1979, and Percentage Decrease in Saturated	OXIDATION	Day Secondary Refrigerant Freeze Concentra-
Thickness, 1950-79, of Unconsolidated Aquifer,	Hypolimnetic Metabolism in Three Cape Cod	tion Pilot Plant to Treat Aqueous-Organic In-
West-Central, Kansas,	Lakes,	dustrial Streams, Phase 1,
W81-01195 7C	W81-01128 2H	W81-01006 5D

PLANNING	Houston Area, Texas, Spring 1979 and Spring	Determinations of Trace Amounts of 9,10-Anth-
Effective Wastewater Management Planning for	1980,	raquinone in Aqueous Systems by Differential
Small Communities - Part 2,	W81-01196 2F	Pulse Polarography,
W81-01083 6E	POTOMAC-RARITAN-MAGOTHY AQUIFER	W81-01106 5A
Management Audits for the 80's,	SYSTEM	PUMPING PLANTS
W81-01098 6E	Digital-Simulation and Projection of Head	Improved Wastewater Treatment for Holiday
	Changes in the Potomac-Raritan-Magothy	Resort Towns on the Coast,
Water Problems and Research Needs for Wis-	Aquifer System, Coastal Plain, New Jersey,	W81-01081 5D
consin, A 5-Year Plan,	W81-01185 2F	DADIOACTIVE WELL LOCCING
W81-01159 6E		RADIOACTIVE WELL LOGGING Use of Geophysical Logs to Estimate Water-
Five-Year Water Resources Research and De-	POWER PLANTS	Quality Trends in Carbonate Aquifers,
velopment Plan, Fiscal Years 1982-1986.	Asiatic Clam Invasion: Causes and Effects,	W81-01029 7B
W81-01160 6E	W81-01173 5C	
	PRE-IMPOUNDMENT	RADIOCHEMICAL ANALYSIS
Planning for Fiscal Years 1982/1986.	Sediment Transport in the Snake and Clearwater	Measurement of Mercury Methylation in Lake
W81-01163 6E	Rivers in the Vicinity of Lewiston, Idaho,	Water and Sediment Samples,
Fire Very Water Barrers Barrers and Da	W81-01037 2J	W81-01047 5A
Five-Year Water Resources Research and De- velopment Plan, Fiscal Years 1982-1986,		RAIN WATER
W81-01164 6E	PREDATION	The Use of the Compartmented Reservoir in
W01-01104 0E	Predator-Prey Relations Important for the	Water Harvesting Agrisystems,
PLANT PHYSIOLOGY	Biotic Changes in Acidified Lakes,	W81-01022 3B
Comparative Resistance of the Soil and the Plant	W81-01129 5C	BAINEAU BINOPEREI ATIONOMINE
to Water Transport,	PRICING	RAINFALL-RUNOFF RELATIONSHIPS
W81-01082 2G	Wholesale Water Pricing: A Cost-To-Serve Plan	The Use of the Compartmented Reservoir in Water Harvesting Agrisystems,
	that Works,	W81-01022 3B
POLAROGRAPHIC ANALYSIS	W81-01104 6C	W81-01022 3B
Determinations of Trace Amounts of 9,10-Anth-	W01-01104	Flood of June 18, 1978, on Honey Creek Tribu-
raquinone in Aqueous Systems by Differential	PROGRAMS	tary at Thornville, Ohio,
Pulse Polarography,	U.S. Geological Survey Activities in New York,	W81-01194 2E
W81-01106 5A	1979.	RECLAMATION
POLLUTANT IDENTIFICATION	W81-01183 7A	Rehabilitation of the Inner Thames Estuary,
Concentration and Determination of Organic	PROJECT DI ANNINIC	W81-01118 5C
Acids in Complex Aqueous Samples,	PROJECT PLANNING	W01-01110
W81-01067 5A	Hydrologic Investigations in the Araguaia-To- cantins River Basin (Brazil),	Changes in the Zooplankton of Onondaga Lake
	W81-01188 7A	(NY), 1969-1978,
Determinations of Trace Amounts of 9,10-Anth-	W01-01100	W81-01122 5C
raquinone in Aqueous Systems by Differential	PROJECTS	RECREATION FACILITIES
Pulse Polarography,	Fiscal 1980 Annual Report to Office of Water	Land Use. Pigs in Pokes: Pork Barrel Water
W81-01106 5A	Research and Technology, USDI.	Projects,
POLYCHLORINATED BIPHENYLS	W81-01004 6E	W81-01063 5C
Enhancement of PCBS Biodegradation by	N. C. de de la Company Auduble de New Yest	
Sodium Ligninsulfonate,	U.S. Geological Survey Activities in New York,	RECYCLING
W81-01133 5D	1979.	Sewage: Waste or Resource,
	W81-01183 7A	W81-01064 5D
POLYMERS	PROTEINS	REGIONAL ANALYSIS
Development of Novel Porous Substrates for	Utilization of the White-Rot Fungus Sporotri-	Water Resources Research Coordination and
Ultrafiltration, Desalination, and Water Recla-	chum Pulverulentum for Water Purification and	Planning in the Missouri River Basin.
mation, W81-01001 3A	Protein Production on Mixed Lignocellulosic	W81-01003 6B
W81-01001 3A	Wastewaters,	DECLE ATTOM
POPULATIONS	W81-01126 5D	REGULATION
Long Term Effect of Sewage Sludge Additions	PROTOTO	Management Audits for the 80's, W81-01098 6E
on Populations of Nocardia Asteroides, Micro-	PROTOZOA	W81-01096
monospora and Thermoactinomyces in Soil,	Electron Microscopy of Giardia Lamblia Cysts,	REMOTE SENSING
W81-01061 5C	W81-01059 5F	Remotely Sensed Crop Temperature for Water
DOOR IN ADOLUNION SENIOR	PUBLIC HEALTH	Resources Management,
POST-IMPOUNDMENT	Philosophy of the Safe Drinking Water Act and	W81-01002 7B
Sediment Transport in the Snake and Clearwater Rivers in the Vicinity of Lewiston, Idaho,	Potable Reuse,	Development of a Model for Estimating the
W81-01037 2J	W81-01120 5D	Extent of River Flooding with Satellite and In
W 01-0103/		Situ Data,
POTABLE WATER	PUBLICATIONS	W81-01203 7E
Low-Cost Filter System Meets Drinking Water	Program Layout - An Interactive Program to	***************************************
Standards,	Handle Page Layout for Documentation of Computer Files Printed on-Line at Remote Ter-	REMOTE TERMINALS
W81-01084 5F		Program Layout - An Interactive Program to
Company of Data Was 1 C	minals, W81-01015 7B	Handle Page Layout for Documentation of
Corrosiveness of Drinking Water and Cardio-	W81-01015 7B	Computer Files Printed on-Line at Remote Ter-
vascular Disease Mortality,	PUERTO RICO	minals,
W81-01109 5F	Water Resources Data for Puerto Rico, Water	W81-01015 7E
Philosophy of the Safe Drinking Water Act and	Year 1977. Surface and Quality-of-Water Re-	REPAIRING
Potable Reuse,	cords and Ground Water Records.	New Ways to Fix Leaky Sewers,
W81-01120 5D	W81-01040 7C	W81-01102 8A
POTENTIOMETRIC LEVEL	PULP WASTES	RESEARCH AND DEVELOPMENT
Model Evaluation of the Hydrogeology of the	Hydraulic Efficiency of Wastewater Lagoon	Water Problems and Research Needs for Wis
Morris Bridge Well Field and Vicinity in West-	Systems,	consin, A 5-Year Plan,
Central Florida,	W81-01093 5D	W81-01159 6E
W81-01027 6A	Irrigation of Intensively Cultured Plantations	Five-Year Water Resources Research and De
Approximate Altitude of Water Levels in Wells	with Paper Mill Effluent,	velopment Plan, Fiscal Years 1982-1986.
in the Chicot and Evangeline Aguifers in the	W81-01094 3C	W81-01160 6E

SUBJECT INDEX

RESEARCH AND DEVELOPMENT

Planning for Fiscal Years 1982/1986.	Predator-Prey Relations Important for the	SALT TOLERANCE
W81-01163 6E	Biotic Changes in Acidified Lakes, W81-01129 5C	Using Saline Water for Crop Production in New Mexico,
Five-Year Water Resources Research and De-	Pro ABAGUATA	W81-01156 3C
velopment Plan, Fiscal Years 1982-1986, W81-01164 6E	RIO ARAGUAIA Hydrologic Investigations in the Araguaia-To-	SAMPLING The Monosaccharide Spectra of Natural Waters,
RESEARCH PRIORITIES	cantins River Basin (Brazil),	W81-01053 2K
Water Problems and Research Needs for Wis-	W81-01188 7A	
consin, A 5-Year Plan, W81-01159 6E	RIO TOCANTINS Hydrologic Investigations in the Araguaia-To-	A Variable-Depth Ground-Water Sampler, W81-01088 5A
Five-Year Water Resources Research and De-	cantins River Basin (Brazil),	Efficiencies of Liquid-Liquid Extraction and
velopment Plan, Fiscal Years 1982-1986. W81-01160 6E	W81-01188 7A RIPLEY COUNTY (IN)	XAD-4 and XAD-7 Resins in Collecting Organ- ic Compounds from a Coke Plant's Effluent,
Planning for Fiscal Years 1982/1986.	A One-Dimensional, Steady-State, Dissolved-	W81-01112 5A
W81-01163 6E	Oxygen Model and Waste-load Assimilation Study for Little Laughery Creek, Ripley and Franklin Counties, Indiana,	Recolonization of Streams by Aquatic Insects Following Channelization, W81-01157 5C
Five-Year Water Resources Research and Development Plan, Fiscal Years 1982-1986,	W81-01025 5B	SAN BERNARDINO VALLEY (CA)
W81-01164 6E	RIVER BASIN COMMISSIONS	Development and Use of a Mathematical Model of the San Bernardino Valley Ground-Water
RESERVOIR OPERATION	Concern Over the Columbia Estuary,	Basin, California,
Design of Objective Functions for Reservoir	W81-01011 6E	W81-01186 2F
Operations, W81-01169 6B	RIVER BASINS Planning and Design of Studies for River-Qual-	SAND ISLAND
RESERVOIR STORAGE	ity Assessment in the Truckee and Carson River	Advanced Primary Treatment for Ocean Dis- charge,
The Use of the Compartmented Reservoir in	Basins, California and Nevada, W81-01024 6A	W81-01079 5D
Water Harvesting Agrisystems,	W 81-01024 0A	SANTA CRUZ COUNTY (CA)
W81-01022 3B RESERVOIRS	Geochemistry of Water in the Fort Union For- mation of the Northern Powder River Basin.	Geology and Ground Water in North-Central Santa Cruz County, California,
Input into and Fate of Lead in a Small Reser-	Southeastern Montana,	W81-01044 7C
voir,	W81-01041 5B	CAMPIA INTO (A PRINCIPAL)
W81-01045 5B	Hydrologic Investigations in the Araguaia-To-	SATELLITES (ARTIFICIAL) Development of a Model for Estimating the
A Reaction Chamber for Study of Interactions between Sediments and Water under Conditions	cantins River Basin (Brazil), W81-01188 7A	Extent of River Flooding with Satellite and In Situ Data,
of Static or Continuous Flow,	RIVERS	W81-01203 7B
W81-01137 5B	Variability and Loading of Mercury in a Small	SCREENS
Design of Objective Functions for Reservoir Operations,	Prairie River, W81-01110 5B	Screening at a Fellmongery. W81-01107 5D
W81-01169 6B		SEA WATER
DECORT TOURIS	The Orr Ditch Case, 1913-1944, W81-01161 6E	Chlorine Disappearance in Sea Water,
RESORT TOWNS Improved Wastewater Treatment for Holiday	W81-01101	W81-01143 5F
Resort Towns on the Coast, W81-01081 5D	Water-Quality Monitoring of Three Major Tri- butaries to the Chesapeake BayInterim Data	SEDIMENT TRANSPORT Sediment Transport of Streams Tributary to San
	Report,	Francisco, San Pablo, and Suisun Bays, Califor-
RETENTION	W81-01184 7C	nia, 1909-66,
A Correlation Method for the Estimation of Retention Times at Full-Scale Sewage Treat-	ROCKS Relationship of Pollution to Rocky Substratum	W81-01034 2J
ment Plants, W81-01150 5D	Polychaetes on the French Mediterranean Coast,	Sediment Transport in the Snake and Clearwater Rivers in the Vicinity of Lewiston, Idaho,
	W81-01099 5A	W81-01037 2J
REVERSE OSMOSIS	RUNOFF	SEDIMENT-WATER INTERFACES
Development of Novel Porous Substrates for Ultrafiltration, Desalination, and Water Recla-	Designing Irrigation-Cum-Drainage Ponds for	In-Situ Registration of Oxygen Utilization at Sediment-Water Interfaces,
mation, W81-01001 3A	Alkali Lands, W81-01113 4A	W81-01054 2K
Para Para Para Para Para Para Para Para	Efficient Design of Stormwater Holding Basins	Psychrophiles, Psychrotrophs, and Mesophiles
Boron Recovery by Reverse Osmosis, W81-01056 5D	Used for Water Quality Protection,	in an Environment which Experiences Seasonal Temperature Fluctuations,
Desalination/Power Cycles with the Biphase	W81-01136 5G	W81-01124 5A
Rotary Separator and Turbine, W81-01165 3A	SACRAMENTO RIVER Low-Cost Filter System Meets Drinking Water	A Reaction Chamber for Study of Interactions
	Standards,	between Sediments and Water under Conditions of Static or Continuous Flow,
Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater	W81-01084 5F	W81-01137 5B
Desalination,	SALINITY	SEDIMENTS
W81-01166 3A	A Salt Balance Simulation Model of Lake Nasser,	Variability and Loading of Mercury in a Small
Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater	W81-01073 2H	Prairie River, W81-01110 5B
Deslination,	Effect of the Salinity of Irrigation Water on	Sediment Oxygen Demand Techniques: A
W81-01167 3A	Wheat Yield and Soil Properties,	Review and Comparison of Laboratory and in
DEVIEWS	W81-01114 3C	Situ Systems,
REVIEWS Some Problems of Aquatic Environments in	SALT BALANCE	W81-01149 5A
Egypt from a General Viewpoint of Nile Ecol-	A Salt Balance Simulation Model of Lake	Kinetics of Trace Metal Partitioning in Model
ogy,	Nasser,	Anoxic Marine Sediments,
W81-01072 5C	W81-01073 2H	W81-01154 5B

Translocation of Mercury and Microbial Adap-	A Correlation Method for the Estimation of	SODIUM
tation in a Model Aquatic System, W81-01174 5B	Retention Times at Full-Scale Sewage Treat- ment Plants,	Effects of Bicarbonate on Sodium Hazard of Irrigation Water: Alternative Formulation,
CERABATION TECHNIQUES	W81-01150 5D	W81-01089 2G
SEPARATION TECHNIQUES Design and Specifications of a 500 Gallon Per	SEWER OVERFLOWS	SODIUM CHLORIDE
Day Secondary Refrigerant Freeze Concentra- tion Pilot Plant to Treat Aqueous-Organic In-	Pilot Scale Evaluation of Physical-Chemical Wastewater Treatment System for Combined	Chloride Ions in Aqueous Solutions, W81-01049
dustrial Streams, Phase 1,	Sewer Overflows.	Effect of the Salinity of Irrigation Water on
W81-01006 5D		Wheat Yield and Soil Properties, W81-01114 3C
Different Methods to Extract Sewage Sludge for the Cultivation of Chlorella Pyrenoidosa,	SEWERAGE Pilot Scale Evaluation of Physical-Chemical	SOIL ANALYSIS
W81-01069 5D	Wastewater Treatment System for Combined Sewer Overflows.	Chemical and Spectroscopic Characterization of Humic Substances Derived from River Swamps
Desalination/Power Cycles with the Biphase Rotary Separator and Turbine,	W81-01020 8B	in the Flood Plains of Southeastern U.S. Coastal Streams,
W81-01165 3A	SEWERS New Ways to Fix Leaky Sewers,	W81-01158 5A
Packed Bed Filtration: Experimental Investiga- tion and Conceptual Analysis of Filter Ripening	W81-01102 8A SIMULATION ANALYSIS	SOIL FUNGI Long Term Effect of Sewage Sludge Additions
Model, W81-01168 5D	Model Evaluation of the Hydrogeology of the Morris Bridge Well Field and Vicinity in West-	on Populations of Nocardia Asteroides, Micromonospora and Thermoactinomyces in Soil, W81-01061 5C
SEPARATORS	Central Florida,	W81-01081
Desalination/Power Cycles with the Biphase	W81-01027 6A	SOIL-PLANT-WATER RELATIONSHIPS Application of Sewage Effluent to Columns of a
Rotary Separator and Turbine, W81-01165 3A	Simulated Effects of a Proposed Well Field on	Mountain Meadow Soil: I. Errors in Calculating
SEWAGE EFFLUENTS	the Groundwater System in the Salt River Indian Reservation, Maricopa County, Arizona,	the Transport of Ionic Salts, W81-01090 3C
Application of Sewage Effluent to Columns of a	W81-01191 2F	Irrigation of Intensively Cultured Plantations
Mountain Meadow Soil: I. Errors in Calculating the Transport of Ionic Salts,	SLUDGE DIGESTION	with Paper Mill Effluent, W81-01094 3C
W81-01090 3C	Digester Methane Utilization Can be Optimized, W81-01095 5D	W81-01094
SEWAGE SLUDGE		SOIL TYPES
Long Term Effect of Sewage Sludge Additions	SLUDGE DISPOSAL Sewage: Waste or Resource,	Interactions and Survival of Enteric Viruses in Soil Materials,
on Populations of Nocardia Asteroides, Micro- monospora and Thermoactinomyces in Soil,	W81-01064 5D	W81-01171 5B
W81-01061 5C	Metal Uptake by Crops Grown Over En-	SOIL WATER Third-Order Integral Relation Between Sorpti-
Different Methods to Extract Sewage Sludge for	trenched Sewage Sludge, W81-01100 5E	vity and Soil Water Diffusivity Using Brutsaert's
the Cultivation of Chlorella Pyrenoidosa, W81-01069 5D	Los Angeles to Meet Regs with Energy-Miser	Technique, W81-01076 2G
	Sludge Processor,	SOIL WATER MOVEMENT
Metal Uptake by Crops Grown Over En- trenched Sewage Sludge,	W81-01152 5D	Comparative Resistance of the Soil and the Plant to Water Transport,
W81-01100 5E	SLUDGE TREATMENT Sludge Dewatering,	W81-01082 2G
SEWAGE SYSTEMS	W81-01071 5D	A Closed-Form Equation for Predicting the Hy-
Manual of Practice on Urban Drainage. W81-01021 10D	An Automated System for Monitoring the Ki-	draulic Conductivity of Unsaturated Soils, W81-01087 2G
SEWAGE TREATMENT	netics of Biological Oxidation of Ammonia,	Saturated Handward Flow in Badial Disco
Sewage: Waste or Resource,	W81-01135 5B	Saturated-Unsaturated Flow in Radial Direc- tions Generated by an Injection Well,
W81-01064 5D	Comment, W81-01146 5D	W81-01091 2G
Conception of Plans for a Marseille Purifying Facility. (Conception du Projet de la Station	Los Angeles to Meet Regs with Energy-Miser	Comparison of One-Step Outflow Laboratory Method to an in Situ Method for Measuring
d'Epuration de Marseille),	Sludge Processor,	Hydraulic Conductivity, W81-01092 2G
W81-01078 5D	W81-01152 5D	
Advanced Primary Treatment for Ocean Dis- charge,	SLUDGE WORMS Taxonomy, Pollution and Sludge Worm,	SOIL-WATER-PLANT RELATIONSHIPS Comparative Resistance of the Soil and the Plant
W81-01079 5D	W81-01117 5A	to Water Transport, W81-01082 2G
New Concepts for the Treatment of Sewage	SNAKE RIVER (ID)	SOILS
Discharged to the Sea, W81-01080 5D	Sediment Transport in the Snake and Clearwater Rivers in the Vicinity of Lewiston, Idaho,	Interactions and Survival of Enteric Viruses in
Wastewater Treatment Process Evaluated by	W81-01037 2J	Soil Materials, W81-01171 5B
Force Account,	SNOW MANAGEMENT	SOLAR RADIATION
W81-01086 6B	Reconnaissance Snow Survey of the National Petroleum Reserve in Alaska, April-May 1979,	Photolysis of 3,4-Dichloroaniline in Natural Waters,
Los Angeles, Glendale Share Reuse Plant's Pro- visions,	W81-01187 2C	W81-01101 5A
W81-01096 5D	SNOW SURVEYS Reconnaissance Snow Survey of the National	SOLIDS CONTACT Solids-Contact Clarification Brings Out Best of
Solids-Contact Clarification Brings Out Best of Trickling Filters,	Petroleum Reserve in Alaska, April-May 1979, W81-01187 2C	Trickling Filters,
W81-01097 5D		W81-01097 5D
Response to Comments by A. P. Walker, W. F.	SNOWFALL Reconnaissance Snow Survey of the National	SOLIDS CONTACT PROCESSES The Effect of Concentration of Adsorbing
Holman and R. H. Wendt,	Petroleum Reserve in Alaska, April-May 1979,	Solids on the Partition Coefficient,
W81-01147 5D	W81-01187 2C	W81-01144 SE

SOLUBILITY

SOLUBILITY Determination of the Aqueous Solubilities of	STORMWATER MANAGEMENT Report of the Urban Drainage Sub-Committee	Water Resources Data for Washington, Water Year 1979Volume 2. Eastern Washington.
Organic Liquids at 10.0, 20.0, and 30.0 C by	Projects Conducted 1972-1978. W81-01019 5D	W81-01177 7C
Elution Chromatography,	W81-01019 5D	Water Resources Data for Missouri, Water Year
W81-01127 5A	STREAMFLOW	1979.
SORPTION	Water Quality of Bear Creek Basin, Jackson County, Oregon,	W81-01178 7C
Third-Order Integral Relation Between Sorpti- vity and Soil Water Diffusivity Using Brutsaert's	W81-01032 5A	Water Resources Data for West Virginia, Water
Technique, W81-01076 2G	Sediment Transport of Streams Tributary to San	Year 1979. W81-01179 7C
***************************************	Francisco, San Pablo, and Suisun Bays, Califor- nia, 1909-66,	A Statistical Analysis of the Quality of Surface
SOUTHEAST FLORIDA	W81-01034 2J	Water in Nebraska,
Geologic Aspects of the Surficial Aquifer in the		W81-01180 7C
Upper East Coast Planning Area, Southeast	Recolonization of Streams by Aquatic Insects	70
Florida,	Following Channelization,	Water-Resources Investigations of the U.S. Geo-
W81-01038 4B	W81-01157 5C	logical Survey in ColoradoFiscal Year 1980.
SOUTHEASTERN MONTANA	STREAMS	W81-01182 7A
Statistical Analyses of Surface-Water-Quality	Statistical Analyses of Surface-Water-Quality	Water-Quality Investigation of the Caney Creek
Variables in the Coal Area of Southeastern Mon-	Variables in the Coal Area of Southeastern Mon-	Watershed, Northeast Arkansas,
tana,	tana,	W81-01189 6A
W81-01023 5B	W81-01023 5B	
COLUMN THE INDIAN RECEDIATION	An Economic Analysis of Selected Strategies for	SURVEYS
SOUTHERN UTE INDIAN RESERVATION	Dissolved-Oxygen Management: Chattahoochee	St. Lawrence River Water Quality Surveys,
(CO) Availability and Quality of Groundwater South	River, Georgia,	1977,
Availability and Quality of Groundwater, South- ern Ute Indian Reservation, Southwestern Colo-	W81-01036 5B	W81-01014 5B
rado,		Water-Resources Reconnaissance of the South-
W81-01197 5B	Quality of Water in the Black River Near Dunn,	eastern Part of St. Paul Island, Pribilof Islands,
W01-01177	North Carolina, and Ground-Water Levels Ad- jacent to the River Prior to Channel Excavation	Alaska,
SPECIFICATIONS	in 1976-79,	W81-01033 4A
Made to Measure,	W81-01193 6A	
W81-01074 8A		SUSPENDED SOLIDS
ODDOTTO ODLIGATO APPROV	Flood of June 18, 1978, on Honey Creek Tribu-	A Correlation Method for the Estimation of
SPECTROPHOTOMETRY The Effect of Surfactants, Cations, and Com-	tary at Thornville, Ohio,	Retention Times at Full-Scale Sewage Treat-
plexing Agents on the Spectrophotometric De-	W81-01194 2E	ment Plants,
termination of Microgram Amounts of Uranium	STRESS ANALYSIS	W81-01150 5D
in Waters,	The Role of Cortisol in Stress-Induced Metabol-	SWAMPS
W81-01052 5A	ic Changes in Fundulus Heteroclitus,	Litterfall, Stemflow, and Throughfall Nutrient
	W81-01007 5C	Fluxes in an Alluvial Swamp Forest,
Experimental Assessment of Haloform Reaction	CTDUCTUDAL CHARES	W81-01065 5B
Precursors (Etude d'une Methode d'Evaluation	STRUCTURAL SHAPES Made to Measure,	
Globale des Precurseurs de la Reaction Halo-	W81-01074 8A	Chemical and Spectroscopic Characterization of
forme), W81-01151 5D	***************************************	Humic Substances Derived from River Swamps in the Flood Plains of Southeastern U.S. Coastal
W01-01151 3D	SUPPLEMENTAL IRRIGATION	Streams,
SPECTROSCOPY	Using Saline Water for Crop Production in New	W81-01158 5A
Chemical and Spectroscopic Characterization of	Mexico,	
Humic Substances Derived from River Swamps	W81-01156 3C	TELEOSTS
in the Flood Plains of Southeastern U.S. Coastal	SURFACE WATERS	The Role of Cortisol in Stress-Induced Metabol-
Streams,	Water Resources of Boulder County, Colorado,	ic Changes in Fundulus Heteroclitus,
W81-01158 5A	W81-01031 5B	W81-01007 5C
ST. LAWRENCE RIVER	Water Quality of Bear Creek Basin, Jackson	TEMPERATURE
St. Lawrence River Water Quality Surveys,	County, Oregon,	Remotely Sensed Crop Temperature for Water
1977,	W81-01032 5A	Resources Management,
W81-01014 5B		W81-01002 7B
ST PAUL ISLAND (AK)	Water-Resources Reconnaissance of the South-	Parahambilas Parahamba and Maraham
Water-Resources Reconnaissance of the South-	eastern Part of St. Paul Island, Pribilof Islands, Alaska.	Psychrophiles, Psychrotrophs, and Mesophiles in an Environment which Experiences Seasonal
eastern Part of St. Paul Island, Pribilof Islands,	W81-01033 4A	Temperature Fluctuations,
Alaska,		W81-01124 5A
W81-01033 4A	Water-Quality Assessment of the Porter County	
	Watershed, Kankakee River Basin, Porter	Analysis of Thermal Impact in Tidal Rivers and
STORM DRAINS	County, Indiana,	Estuaries,
Efficient Design of Stormwater Holding Basins	W81-01035 5B	W81-01142 5C
Used for Water Quality Protection, W81-01136 5G	Water Resources Data for Montana, Water Year	TEMPERATURE CONTROL
W81-01136 5G	1979.	Anticipate Pipe Freeze-Ups,
STORM RUNOFF	W81-01039 7C	W81-01075 3D
Input into and Fate of Lead in a Small Reser-	Water Resources Data for Puerto Rico, Water	
voir,	Year 1977. Surface and Quality-of-Water Re-	TENNESSEE
W81-01045 5B	cords and Ground Water Records.	Susceptibility of the Memphis Water Supply to
Madellan de Donald D	W81-01040 7C	Contamination from the Pesticide Waste Dispos-
Modeling the Runoff Process in Urban Areas,		al Site in Northeastern Hardeman County, Ten-
W81-01153 2A	Water Resources Data for Pennsylvania, Water	nessee, W81-01192 5E
STORM SURGE	Year 1979Volume 1. Delaware River Basin. W81-01042 7C	W 01*01174 JE
Predicting the Effects of Storm Surges and Ab-	W81-01042 7C	TERRACING
normal River Flow on Flooding and Water	Water Resources Data For Washington, Water	Costs and Benefits of Terraces for Erosion Con-
Movement in Mobile Bay, Alabama,	Year 1979Volume 1. Western Washington.	trol,
W81-01008 2F	W81-01176 7C	W81-01062 4D

	THE PERSON NAMED IN COLUMN	
TESTING	TURBULENCE	Study for Little Laughery Creek, Ripley and
Test Monitoring of Prototype Injection Well,	The Aquatic Vegetation of Llangorse Lake,	Franklin Counties, Indiana,
Waiale, Maui, Hawaii, W81-01190 6A	Wales,	W81-01025 5B
W81-01190 6A	W81-01131 5C	WASTE DISPOSAL
TESTING PROCEDURES	Analysis of Thermal Impact in Tidal Rivers and	Metal Uptake by Crops Grown Over En-
Development of Novel Porous Substrates for	Estuaries.	trenched Sewage Sludge,
Ultrafiltration, Desalination, and Water Recla-	W81-01142 5C	W81-01100 5E
mation,		THE A CORPORATION OF THE PARTY AND CO.
W81-01001 3A	U.S. GEOLOGICAL SURVEY	WASTE DUMPS
THAMES RIVER	U.S. Geological Survey Activities in New York,	Susceptibility of the Memphis Water Supply to
Rehabilitation of the Inner Thames Estuary,	1979.	Contamination from the Pesticide Waste Dispos-
W81-01118 5C	W81-01183 7A	al Site in Northeastern Hardeman County, Ten- nessee,
W01-01110	ULTIMATE DISPOSAL	W81-01192 5B
THERMAL PROPERTIES	Los Angeles to Meet Regs with Energy-Miser	W81-01172 3D
The Thermal Sensitivity of Nitrification as a	Sludge Processor.	WASTE STORAGE
Function of the Concentration of Nitrogen Sub-	W81-01152 5D	Hydraulic Efficiency of Wastewater Lagoon
strate,		Systems,
W81-01145 5D	UNCONSOLIDATED AQUIFERS	W81-01093 5D
TIDAL STREAMS	Maps Showing Saturated Thickness, January	WASTE THE ATMENT
Analysis of Thermal Impact in Tidal Rivers and	1979, and Percentage Decrease in Saturated	WASTE TREATMENT Chemical Dosage Control for Phosphorus Re-
Estuaries,	Thickness, 1950-79, of Unconsolidated Aquifer,	moval.
W81-01142 5C	West-Central, Kansas,	W81-01018 5D
	W81-01195 7C	W61-01016 3D
TOXICITY	URANIUM RADIOISOTOPES	WASTE WATER DISPOSAL
Asbestos Fibres in Receiving Waters,	The Effect of Surfactants, Cations, and Com-	Sand Cambisol Functioning as a Filter through
W81-01013 5A	plexing Agents on the Spectrophotometric De-	Long-Term Irrigation with Wastewater,
TRACE ELEMENTS	termination of Microgram Amounts of Uranium	W81-01130 5D
Trace Elements in Water and Biological Sam-	in Waters,	
ples Determined by X-Ray Spectroscopy,	W81-01052 5A	WASTE WATER POLLUTION
W81-01077 5A		Efficiencies of Liquid-Liquid Extraction and
	URBAN DRAINAGE	XAD-4 and XAD-7 Resins in Collecting Organ-
Analyzing for Trace Chemicals in Water: A	Report of the Urban Drainage Sub-Committee	ic Compounds from a Coke Plant's Effluent,
Manager's Guide,	Projects Conducted 1972-1978.	W81-01112 5A
W81-01085 5A	W81-01019 5D	WASTE WATER TREATMENT
Mussels (Mytilus Edulis) as 'Point Source' Indi-	Manual of Practice on Urban Drainage.	Design and Specifications of a 500 Gallon Per
cators of Trace Metal Pollution.	W81-01021 10D	Day Secondary Refrigerant Freeze Concentra-
W81-01115 5A	W81-01021	tion Pilot Plant to Treat Aqueous-Organic In-
W81-01113	Modeling the Runoff Process in Urban Areas,	dustrial Streams, Phase 1,
Kinetics of Trace Metal Partitioning in Model	W81-01153 2A	W81-01006 5D
Anoxic Marine Sediments,		
W81-01154 5B	URBAN HYDROLOGY	Plating Waste Treatment,
	Modeling the Runoff Process in Urban Areas,	W81-01057 5D
TRANSPIRATION	W81-01153 2A	Conception of Plans for a Marseille Purifying
Water Movement Through Stands of Lodgepole	URBAN RUNOFF	Facility. (Conception du Projet de la Station
Pine Forest in Wyoming, W81-01175 2D	Efficient Design of Stormwater Holding Basins	d'Epuration de Marseille),
W61-01175 2D	Used for Water Quality Protection,	W81-01078 5D
TRANSPORTATION	W81-01136 5G	
		New Concepts for the Treatment of Sewage
Navigation as an Alternative Use,		
Navigation as an Alternative Use, W81-01202 6B	Modeling the Runoff Process in Urban Areas,	Discharged to the Sea,
W81-01202 6B	Modeling the Runoff Process in Urban Areas, W81-01153 2A	Discharged to the Sea, W81-01080 5D
W81-01202 6B TREATIES	W81-01153 2A	W81-01080 5D
W81-01202 6B TREATIES International Management of the Columbia,	W81-01153 2A UTAH	W81-01080 5D Improved Wastewater Treatment for Holiday
W81-01202 6B TREATIES	W81-01153 2A UTAH Seepage Study of the West Side and West	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast,
W81-01202 6B TREATIES International Management of the Columbia,	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah,	W81-01080 5D Improved Wastewater Treatment for Holiday
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E	W81-01153 2A UTAH Seepage Study of the West Side and West	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast,
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah,	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2,
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters,	W81-0153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account.
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater,	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters,	W81-0153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater,	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account.
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV)	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada,	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of
TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters,
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV)	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary,	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944,	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV)	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater TreatmentStoi
W81-01202 6B TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944,	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington, Water	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D
TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 5C	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington, Water Year 1979Volume I. Western Washington.	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater TreatmentStoichiometric Relationships, W81-01105 5D
TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 5C TURBIDITY	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington. Water Year 1979Volume 1. Western Washington.	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater Treatment-Stoichiometric Relationships, W81-01105 5D Flow Equalize All Influent.
TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 5C TURBIDITY Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnetic Polymer Composites,	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington, Water Year 1979Volume 1. Western Washington. W81-01176 7C Water Resources Data for Washington, Water	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater TreatmentStoichiometric Relationships, W81-01105 5D
TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 5C TURBIDITY Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnet-	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington, Water Year 1979Volume I. Western Washington. W81-01176 7C Water Resources Data for Washington, Water Year 1979Volume 2. Eastern Washington.	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater TreatmentStoichiometric Relationships. SE Flow Equalize All Influent. W81-01119 5D
TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 5C TURBIDITY Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnetic Polymer Composites, W81-01141 5F	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington, Water Year 1979Volume 1. Western Washington. W81-01176 7C Water Resources Data for Washington, Water	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater TreatmentStoichiometric Relationships. W81-01105 5D Flow Equalize All Influent. W81-01119 5D Utilization of the White-Rot Fungus Sporotri
TREATIES International Management of the Columbia, W81-01201 TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 TURBIDITY Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnetic Polymer Composites, W81-01141 5F TURBINES	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington, Water Year 1979Volume 1. Western Washington, W81-01176 7C Water Resources Data for Washington, Water Year 1979Volume 2. Eastern Washington. W81-01177 7C	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater Treatment-Stoichiometric Relationships, W81-01105 5D Flow Equalize All Influent, W81-01119 5D Utilization of the White-Rot Fungus Sporotrichum Pulverulentum for Water Purification and
TREATIES International Management of the Columbia, W81-01201 6E TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 5D TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 5C TURBIDITY Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnetic Polymer Composites, W81-01141 5F TURBINES Desalination/Power Cycles with the Biphase	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington, Water Year 1979Volume 1. Western Washington, W81-01176 7C Water Resources Data for Washington, Water Year 1979Volume 2. Eastern Washington. W81-01177 7C WASTE ASSIMULATIVE CAPACITY	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater TreatmentStoichiometric Relationships, W81-01105 5D Flow Equalize All Influent, W81-01119 5D Utilization of the White-Rot Fungus Sportori chum Pulverulentum for Water Purification and Protein Production on Mixed Lignocellulosic
TREATIES International Management of the Columbia, W81-01201 TREATMENT FACILITIES Flow Equalize All Influent, W81-01119 TRICKLING FILTERS Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 TRUCKEE RIVER BASIN (CA-NV) Planning and Design of Studies for River-Quality Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 TRUCKEE RIVER BASIN (NV) The Truckee Basin Fishery, 1844-1944, W81-01162 TURBIDITY Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnetic Polymer Composites, W81-01141 5F TURBINES	W81-01153 2A UTAH Seepage Study of the West Side and West Canals, Box Elder County, Utah, W81-01026 4A VIRGIN ISLANDS Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D VIRUSES Viruses in Groundwater, W81-01121 5B Interactions and Survival of Enteric Viruses in Soil Materials, W81-01171 5B WASHINGTON Concern Over the Columbia Estuary, W81-01011 6E Water Resources Data For Washington, Water Year 1979Volume 1. Western Washington, W81-01176 7C Water Resources Data for Washington, Water Year 1979Volume 2. Eastern Washington. W81-01177 7C	W81-01080 5D Improved Wastewater Treatment for Holiday Resort Towns on the Coast, W81-01081 5D Effective Wastewater Management Planning for Small Communities - Part 2, W81-01083 6E Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D Activated Sludge Wastewater Treatment-Stoichiometric Relationships, W81-01105 5D Flow Equalize All Influent, W81-01119 5D Utilization of the White-Rot Fungus Sporotrichum Pulverulentum for Water Purification and

WASTE WATER TREATMENT

Ultrafiltration Processes for Pollution Control and Chemical Reuse in the Tanning Industry, W81-01139 5D	Availability and Quality of Groundwater, South- ern Ute Indian Reservation, Southwestern Colo- rado,	Effects of Heavy Metals in Combination with NTA, Humic Acid, and Suspended Sediment on Natural Phytoplankton Photosynthesis,
Effect of Alcohols on the Mechanical and	W81-01197 5B	W81-01108 5C
Transport Properties of Asymmetric Cellulose Acetate Membranes, W81-01148 5D	WATER CONSERVATION The Use of the Compartmented Reservoir in	The Truckee Basin Fishery, 1844-1944, W81-01162 5C
	Water Harvesting Agrisystems, W81-01022 3B	WATER POLLUTION SOURCES
Packed Bed Filtration: Experimental Investiga- tion and Conceptual Analysis of Filter Ripening Model,	WATER COOLING Offshore Water Intakes Designed to Protect	An Economic Analysis of Selected Strategies for Dissolved-Oxygen Management: Chattahoochee River, Georgia,
W81-01168 5D	Fish,	W81-01036 5B
Interactions and Survival of Enteric Viruses in	W81-01070 6G	New Concepts for the Treatment of Sewage
Soil Materials, W81-01171 5B	WATER DISTRIBUTION (APPLIED) Water Usage Patterns in the U.S. Virgin Islands,	Discharged to the Sea, w81-01080 5D
Treatment of Dilute Metal Effluents in an Elec-	W81-01005 6D	Screening at a Fellmongery.
trolytic Precipitator, W81-01172 5D	WATER HARVESTING	W81-01107 5D
	The Use of the Compartmented Reservoir in	
WASTEWATER TREATMENT Report of the Urban Drainage Sub-Committee Projects Conducted 1972-1978.	Water Harvesting Agrisystems, W81-01022 3B	Mussels (Mytilus Edulis) as 'Point Source' Indi- cators of Trace Metal Pollution, W81-01115 5A
W81-01019 5D	WATER LEVEL FLUCTUATIONS	W81-01115
Storage-Induced Denitrification Using Sequencing Batch Reactor Operation,	Ground-Water Levels in New Mexico, 1977, W81-01181 7C	Comment, W81-01146 5D
W81-01132 5D	WATER LEVELS	Wastewater Characterization in a Multiproduct
WASTEWATER TREATMENT *SEWER	Quality of Water in the Black River Near Dunn,	Dairy,
OUTFALLS	North Carolina, and Ground-Water Levels Ad-	W81-01170 5F
Pilot Scale Evaluation of Physical-Chemical Wastewater Treatment System for Combined	jacent to the River Prior to Channel Excavation in 1976-79,	WATER PURIFICATION
Sewer Overflows.	W81-01193 6A	Electron Microscopy of Giardia Lamblia Cysts,
W81-01020 8B	Approximate Altitude of Water Levels in Wells	W81-01059 5F
WATER ANALYSIS	in the Chicot and Evangeline Aquifers in the	Experimental Assessment of Haloform Reaction
Changes in Nutrient Ion Level of Substrates and Stream Water Due to Land Management in	Houston Area, Texas, Spring 1979 and Spring 1980,	Precursors (Etude d'une Methode d'Evaluation Globale des Precurseurs de la Reaction Halo-
Northumberland,	W81-01196 2F	forme),
W81-01046 5C	WATER MANAGEMENT (APPLIED)	W81-01151 5D
The Effect of Surfactants, Cations, and Com-	Water Usage Patterns in the U.S. Virgin Islands,	WATER QUALITY
plexing Agents on the Spectrophotometric De- termination of Microgram Amounts of Uranium	W81-01005 6D	St. Lawrence River Water Quality Surveys, 1977,
in Waters,	Geologic Aspects of the Surficial Aquifer in the	W81-01014 5B
W81-01052 5A	Upper East Coast Planning Area, Southeast Florida,	Manual of Practice on Urban Drainage.
Trace Elements in Water and Biological Sam- ples Determined by X-Ray Spectroscopy,	W81-01038 4B	W81-01021 10D
W81-01077 5A	Effective Wastewater Management Planning for	Statistical Analyses of Surface-Water-Quality
Analyzing for Trace Chemicals in Water: A	Small Communities - Part 2,	Variables in the Coal Area of Southeastern Mon- tana,
Manager's Guide, W81-01085 5A	W81-01083 6E	W81-01023 5B
	WATER POLLUTION	Planning and Design of Studies for River-Qual-
A Variable-Depth Ground-Water Sampler, W81-01088 5A	Differential Pulse Anodic Stripping Voltam- metry of Copper(II) at the Glassy Carbon Elec- trode,	ity Assessment in the Truckee and Carson River Basins, California and Nevada,
Efficiencies of Liquid-Liquid Extraction and XAD-4 and XAD-7 Resins in Collecting Organ-	W81-01010 5A	W81-01024 6A
ic Compounds from a Coke Plant's Effluent, W81-01112 5A	Behaviour of Phosphate in Estuarine Water, W81-01050 5B	A One-Dimensional, Steady-State, Dissolved- Oxygen Model and Waste-load Assimilation
A Well-Head Instrument Package for Multi-Pa-	Variability and Loading of Mercury in a Small	Study for Little Laughery Creek, Ripley and Franklin Counties, Indiana,
rameter Measurement during Well Water Sam-	Prairie River,	W81-01025 5E
pling, W81-01138 5A	W81-01110 5B	Use of Geophysical Logs to Estimate Water-
Sediment Oxygen Demand Techniques: A	Susceptibility of the Memphis Water Supply to	Quality Trends in Carbonate Aquifers,
Review and Comparison of Laboratory and in Situ Systems,	Contamination from the Pesticide Waste Dispos- al Site in Northeastern Hardeman County, Ten-	W81-01029 7E
W81-01149 5A	nessee, W81-01192 5B	Water Resources of Boulder County, Colorado W81-01031 5E
Water-Quality Monitoring of Three Major Tri- butaries to the Chesapeake BayInterim Data	WATER POLLUTION CONTROL	Water Quality of Bear Creek Basin, Jackson
Report,	Lincient Design of Stormwater Holding Basins	County, Oregon, W81-01032 5A
W81-01184 7C	W81-01136 5G	
WATER BALANCE	WATER POLLUTION EFFECTS	Water-Quality Assessment of the Porter County Watershed, Kankakee River Basin, Porte
Comparative Resistance of the Soil and the Plant to Water Transport,	Influence of Coal Humic Acid on the Growth of	County, Indiana.
W81-01082 2G		W81-01035 5E
WATER CHEMISTRY	W81-01009 5C	Water Resources Data for Montana. Water Yea
Chlorine Disappearance in Sea Water, W81-01143 5F	Manual of Practice on Urban Drainage.	1979.
W81-01143 5F	W81-01021 10D	W81-01039 70

Year 1977. Surface and Quality-of-Water Re-	Wholesale Water Pricing: A Cost-To-Serve Plan	Low-Cost Filter System Meets Drinking Water Standards,
cords and Ground Water Records. W81-01040 7C	that Works,	W81-01084 5F
W81-01040 7C	W81-01104 6C	Packed Bed Filtration: Experimental Investiga-
Geochemistry of Water in the Fort Union For- mation of the Northern Powder River Basin,	WATER RESOURCE Water Resources of Boulder County, Colorado,	tion and Conceptual Analysis of Filter Ripening
Southeastern Montana,	W81-01031 5B	Model, W81-01168 5D
W81-01041 5B	WATER RESOURCES	
Water Resources Data for Pennsylvania, Water	Seepage Study of the West Side and West	WATER UTILIZATION
Year 1979-Volume 1. Delaware River Basin. W81-01042 7C	Canals, Box Elder County, Utah, W81-01026 4A	Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D
		The Orr Ditch Case, 1913-1944,
Lakes of Oregon: Volume 6. Douglas County, W81-01043 2H	Water-Resources Reconnaissance of the South- eastern Part of St. Paul Island, Pribilof Islands,	W81-01161 6E
Geology and Ground Water in North-Central Santa Cruz County, California,	Alaska, W81-01033 4A	Ground-Water Levels in New Mexico, 1977, W81-01181 7C
W81-01044 7C	Water-Resources Investigations of the U.S. Geo-	WATER WELLS
Viruses in Groundwater,	logical Survey in Colorado-Fiscal Year 1980. W81-01182 7A	A Variable-Depth Ground-Water Sampler,
W81-01121 5B		W81-01088 5A
Water Problems and Research Needs for Wisconsin, A 5-Year Plan,	WATER RESOURCES DEVELOPMENT Planning and Design of Studies for River-Qual-	
W81-01159 6E	ity Assessment in the Truckee and Carson River Basins, California and Nevada,	pling,
Five-Year Water Resources Research and De-	W81-01024 6A	W81-01138 5A
velopment Plan, Fiscal Years 1982-1986.	Hydrologic Investigations in the Araguaia-To-	Approximate Altitude of Water Levels in Wells
W81-01160 6E	cantins River Basin (Brazil),	in the Chicot and Evangeline Aquifers in the
Planning for Fiscal Years 1982/1986.	W81-01188 7A	Houston Area, Texas, Spring 1979 and Spring 1980.
W81-01163 6E	WATER RESOURCES PLANNING	W81-01196 2F
Five-Year Water Resources Research and De-	Water Resources Research Coordination and	
velopment Plan, Fiscal Years 1982-1986, W81-01164 6E	Planning in the Missouri River Basin. W81-01003	
	WATER REUSE	Research and Technology, USDI.
Water Resources Data For Washington, Water Year 1979Volume 1. Western Washington.	Development of Novel Porous Substrates for	
W81-01176 7C	Ultrafiltration, Desalination, and Water Recla mation.	 WATERSHEDS (BASINS) Water-Quality Assessment of the Porter County
Water Resources Data for Washington, Water Year 1979Volume 2. Eastern Washington.	W81-01001 3A	Watershed, Kankakee River Basin, Porter County, Indiana,
W81-01177 7C	Los Angeles, Glendale Share Reuse Plant's Pro	W81-01035 5B
Water Resources Data for Missouri, Water Year	visions, W81-01096 5I	WEST-CENTRAL KANSAS
1979.		Mana Chausing Saturated Thickness January
W81-01178 7C	Philosophy of the Safe Drinking Water Act an Potable Reuse,	1979, and Percentage Decrease in Saturated
Water Resources Data for West Virginia, Water	W81-01120 51	West-Central, Kansas,
Year 1979. W81-01179 7C	WATER RIGHTS	W81-01195 7C
	The Orr Ditch Case, 1913-1944,	E WEST SIDE CANAL (UT)
A Statistical Analysis of the Quality of Surface Water in Nebraska,	W81-01161 6	Seepage Study of the West Side and West
W81-01180 7C	WATER SAMPLING	Canals, Box Elder County, Utah,
Water-Resources Investigations of the U.S. Geo-	Automatic Sewage Samplers: What to Look for When Buying,	or W81-01026 4A
logical Survey in Colorado-Fiscal Year 1980.		A WEST VIRGINIA
W81-01182 7A	WATER SUPPLY	Water Resources Data for West Virginia, Water
Water-Quality Monitoring of Three Major Tri-	Fiscal 1980 Annual Report to Office of Wat	Year 1979. er W81-01179 70
butaries to the Chesapeake BayInterim Data	Research and Technology, USDI.	***************************************
Report,	W81-01004	E WESTERN WASHINGTON
W81-01184 7C	Asbestos Fibres in Receiving Waters,	Water Resources Data For Washington, Water Year 1979-Volume 1. Western Washington.
Water-Quality Investigation of the Caney Creek Watershed, Northeast Arkansas,	W81-01013 5	A W81-01176 70
W81-01189 6A	Susceptibility of the Memphis Water Supply	
Quality of Water in the Black River Near Dunn,	Contamination from the Pesticide Waste Dispo al Site in Northeastern Hardeman County, Te	
North Carolina, and Ground-Water Levels Ad-	nessee,	VOIF,
jacent to the River Prior to Channel Excavation	W81-01192	B #81-01043
in 1976-79, W81-01193 6A	WATER TABLE	WHEAT
	Simulated Water-Level Declines Near Ma	Effect of the Salinity of Irrigation Water o Wheat Yield and Soil Properties,
Availability and Quality of Groundwater, South- ern Ute Indian Reservation, Southwestern Colo-	ienthal, West-Central Kansas, W81-01030	NB W81-01114 30
rado, W81-01197 5B	WATER TEMPERATURE	WICHITA COUNTY (KS)
	Water Quality of the Columbia River,	Simulated Water-Level Declines Near Mai
WATER QUALITY CONTROL	W81-01200	ienthal, West-Central Kansas, W81-01030 4
Ultrafiltration Processes for Pollution Control and Chemical Reuse in the Tanning Industry,	WATER TREATMENT	
W81-01139 5D	Conception of Plans for a Marseille Purifyi	
Water Quality of the Columbia River,	Facility. (Conception du Projet de la Stati d'Epuration de Marseille),	the Future,
W81-01200 5C		D W81-01048 6

SUBJECT INDEX

WISCONSIN

WISCONSIN
Water Problems and Research Needs for Wis- consin, A 5-Year Plan,
W81-01159 6E
WYOMING
Water Movement Through Stands of Lodgepole
Pine Forest in Wyoming,
W81-01175 2D
X-RAY SPECTROSCOPY
Trace Elements in Water and Biological Sam- ples Determined by X-Ray Spectroscopy,
W81-01077 5A
YARRA RIVER (AUSTRALIA)
Behaviour of Phosphate in Estuarine Water,
W81-01050 5E
ZOOPLANKTON
Changes in the Zooplankton of Onondaga Lake
(NY), 1969-1978,
W81-01122 5C

5C

AUTHOR INDEX

ABDEL-SAMIE, M. E. A Salt Balance Simulation Model of Lake Nasser, W81-01073 2H	BEK, B. Trace Elements in Water and Biological Samples Determined by X-Ray Spectroscopy, W81-01077 5A	BRADSHAW, H. D. Litterfall, Stemflow, and Throughfall Nutrient Fluxes in an Alluvial Swamp Forest, W81-01065 5B
ABRAHAMSEN, H. Effects of Heavy Metals in Combination with NTA, Humic Acid, and Suspended Sediment on Natural Phytoplankton Photosynthesis, W81-01108 5C	BELLAN, G. Relationship of Pollution to Rocky Substratum Polychaetes on the French Mediterranean Coast, W81-01099 5A	BRANNON, J. M. A Reaction Chamber for Study of Interactions between Sediments and Water under Conditions of Static or Continuous Flow, W81-01137 5B
AGEMIAN, H. Interlaboratory Quality Control Study No. 24, Analysis of Eight Acid Herbicides in Natural	BELMONT, T. V. Plating Waste Treatment, W81-01057 5D	BREW, J. S. Mass Balance, W81-01134 5B
Fresh Water, W81-01016 5A	BENOIT, G. R. Low-Cost Filter System Meets Drinking Water Standards,	BRINKHURST, R. O. Taxonomy, Pollution and Sludge Worm,
ALAILY, F. Sand Cambisol Functioning as a Filter through	W81-01084 5F	W81-01117 5A
Long-Term Irrigation with Wastewater, W81-01130 5D	BERG, O. Land Use. Pigs in Pokes: Pork Barrel Water Projects,	BRINSON, M. M. Litterfall, Stemflow, and Throughfall Nutrient Fluxes in an Alluvial Swamp Forest, W81-01065 5B
ALBERTSON, O. E. Advanced Primary Treatment for Ocean Dis-	W81-01063 5C	BROGDEN, R. E.
charge, W81-01079 5D	BLAD, B. L. Remotely Sensed Crop Temperature for Water Resources Management,	Availability and Quality of Groundwater, South- ern Ute Indian Reservation, Southwestern Colo- rado,
ALFANI, F. Effect of Alcohols on the Mechanical and	W81-01002 7B	W81-01197 5B
Transport Properties of Asymmetric Cellulose Acetate Membranes, W81-01148 5D	BLIZZARD, W. E. Comparative Resistance of the Soil and the Plant to Water Transport,	BRONSTAD, J. O. Determinations of Trace Amounts of 9,10-Anthraquinone in Aqueous Systems by Differential
ALLEMAN, J. E.	W81-01082 2G	Pulse Polarography, W81-01106 5A
Storage-Induced Denitrification Using Sequencing Batch Reactor Operation, W81-01132 5D	BLOCK, B. Anticipate Pipe Freeze-Ups, W81-01075 3D	BROWN, W. M. III Planning and Design of Studies for River-Qual-
AMMANN, D. Direct Potentiometric Water Hardness Determination Using Ion-Selective Electrodes,	BLUME, H-P. Sand Cambisol Functioning as a Filter through Long-Term Irrigation with Wastewater,	ity Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A
W81-01051 5A	W81-01130 5D	BRYSON, A. W. Treatment of Dilute Metal Effluents in an Elec-
ANDERSON, N. J. Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnet-	BLYTH, K. Aerial Infrared Photography for Flood Plain Investigations,	trolytic Precipitator, W81-01172 5D
ic Polymer Composites, W81-01141 5F	W81-01055 7B BOBO, L. L.	BULLOCK, D. C. Water Usage Patterns in the U.S. Virgin Islands, W81-01005 6D
ANDREWS, M. J. Rehabilitation of the Inner Thames Estuary, W81-01118 5C	Water-Quality Assessment of the Porter County Watershed, Kankakee River Basin, Porter County, Indiana, W81-01035 5B	BURTON, G. A. A Reaction Chamber for Study of Interactions between Sediments and Water under Conditions
APRIL, G. C. Predicting the Effects of Storm Surges and Abnormal River Flow on Flooding and Water	BOLTO, B. A. Colour and Turbidity Removal with Reusable	of Static or Continuous Flow, W81-01137 5B
Movement in Mobile Bay, Alabama, W81-01008 2E BABU, D. K.	Magnetic Particles-II. Coagulation with Magnetic Polymer Composites, W81-01141 5F	CABASSO, I. Development of Novel Porous Substrates for Ultrafiltration, Desalination, and Water Reclamation.
Saturated-Unsaturated Flow in Radial Directions Generated by an Injection Well, W81-01091 2G	BORS, G. W. Hydraulic Efficiency of Wastewater Lagoon	matton, W81-01001 3A CAIN, D.
BACCHUS, Z.	Systems, W81-01093 5D	Water Resources of Boulder County, Colorado W81-01031 5E
The Aquatic Vegetation of Llangorse Lake, Wales, W81-01131 5C	BOWMAN, G. T. Sediment Oxygen Demand Techniques: A Review and Comparison of Laboratory and in	CAIRNS, J. JR. Asiatic Clam Invasion: Causes and Effects, W81-01173
BADER, E. F. Management Audits for the 80's,	Situ Systems, W81-01149 5A	W81-011 ⁷³ 50 CANTON, S. P. Detrital Processing and Associated Macroinver
W81-01098 6E BANSAL, I. K.	BOYD, E. L. Water Resources of Boulder County, Colorado, W81-01031 5B	tebrates in a Colorado Mountain Stream, W81-01066 5E
Boron Recovery by Reverse Osmosis, W81-01056 5D	BOYER, J. S.	CARAWAN, R. E. Wastewater Characterization in a Multiproduc
BARBARICK, K. A. Application of Sewage Effluent to Columns of a Mountain Meadow Soil: I. Errors in Calculating	Comparative Resistance of the Soil and the Plant to Water Transport, W81-01082 2G	Dairy, W81-01170 5F
the Transport of Ionic Salts, W81-01090 3C	BRACH, J. C. Costs and Benefits of Terraces for Erosion Con-	CARTER, R. W. Design and Specifications of a 500 Gallon Pe Day Secondary Refrigerant Freeze Concentra
BARROR, R. F. Effective Wastewater Management Planning for	trol, W81-01062 4D	tion Pilot Plant to Treat Aqueous-Organic In dustrial Streams, Phase 1,
Small Communities - Part 2, W81-01083 6E	BRADDOCK, R. D. Third-Order Integral Relation Between Sorpti-	W81-01006 5E CHAN, C. H.
BAUMANN, P. G.	vity and Soil Water Diffusivity Using Brutsaert's Technique.	St. Lawrence River Water Quality Surveys
Digester Methane Utilization Can be Optimized, W81-01095 5D	W81-01076 2G	W81-01014 51

CHANEY, R. L.

CHANEY, R. L. Metal Uptake by Crops Grown Over En- trenched Sewage Sludge, W81-01100 5E	DALRYMPLE, J. F. A Correlation Method for the Estimation of Retention Times at Full-Scale Sewage Treat- ment Plants, W81-01150 5D	EFFLER, S. W. Changes in the Zooplankton of Onondaga Lake (NY), 1969-1978, W81-01122 5C
CHAPMAN, R. L. Low-Cost Filter System Meets Drinking Water Standards, W81-01084 5F	DARDIS, K. A. Treatment of Dilute Metal Effluents in an Electrolytic Precipitator,	EISMAN, R. Advanced Primary Treatment for Ocean Dis- charge, W81-01079 5D
CHAU, A. S. Y. Interlaboratory Quality Control Study No. 24, Analysis of Eight Acid Herbicides in Natural Fresh Water, W81-01016 5A	DAWSON, D. H. Irrigation of Intensively Cultured Plantations with Paper Mill Effluent, W81-01094 3C	EK, M. Utilization of the White-Rot Fungus Sporotri- chum Pulverulentum for Water Purification and Protein Production on Mixed Lignocellulosic Wastewaters, W81-01126 5D
CHERRY, D. S. Asiatic Clam Invasion: Causes and Effects, W81-01173 5C	DAWSON, R. The Monosaccharide Spectra of Natural Waters, W81-01053 2K	ELDRIDGE, R. J. Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnet-
CHRISWELL, C. D. Concentration and Determination of Organic Acids in Complex Aqueous Samples,	DEAN, C. H. Interactions and Survival of Enteric Viruses in Soil Materials,	ic Polymer Composites, W81-01141 5F
W81-01067 5A CIMERMAN, Z. Direct Potentiometric Water Hardness Determi-	W81-01171 5B DEL RIO, P. Improved Wastewater Treatment for Holiday Resort Towns on the Coast,	ELKINS, J. B. JR. Litterfall, Stemflow, and Throughfall Nutrient Fluxes in an Alluvial Swamp Forest, W81-01065 5B
nation Using Ion-Selective Electrodes, W81-01051 5A CLARK, D. W.	W81-01081 5D DELFINO, J. J.	ENDERBY, J. E. Chloride Ions in Aqueous Solutions, W81-01049 1B
Analyzing for Trace Chemicals in Water: A Manager's Guide, W81-01085 5A	Sediment Oxygen Demand Techniques: A Review and Comparison of Laboratory and in Situ Systems, W81-01149 5A	ENGBERG, R. A. A Statistical Analysis of the Quality of Surface Water in Nebraska, W81-01180 7C
CLUFF, B. C. The Use of the Compartmented Reservoir in Water Harvesting Agrisystems, W81-01022 3B	DELLEUR, J. W. Modeling the Runoff Process in Urban Areas, W81-01153 2A	EPPEL, D. Analysis of Thermal Impact in Tidal Rivers and Estuaries,
CONNELL, J. E. Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B	DELPHEY, C. E. Kinetics of Trace Metal Partitioning in Model Anoxic Marine Sediments, W81-01154 5B	W81-01142 5C ERIKSSON, K-E. Utilization of the White-Rot Fungus Sporotri- chum Pulverulentum for Water Purification and
CONNOLLY, J. P. The Effect of Concentration of Adsorbing Solids on the Partition Coefficient,	DENDROU, S. A. Modeling the Runoff Process in Urban Areas, W81-01153 2A	Protein Production on Mixed Lignocellulosic Wastewaters, W81-01126 5D
W81-01144 5B CORTESE, B. Ultrafiltration Processes for Pollution Control and Chemical Reuse in the Tanning Industry, W81-01139 5D	DEVANAS, M. A. Coincidence of Cadmium and Antibiotic Resistance in New York Bight Apex Benthic Microorganisms, W81-01116 5B	ERIKSSON, M. O. G. Predator-Prey Relations Important for the Biotic Changes in Acidified Lakes, W81-01129 5C
CRAGG, B. A. The Aquatic Vegetation of Llangorse Lake, Wales,	DEWALLE, F. B. Electron Microscopy of Giardia Lamblia Cysts, W81-01059 5F	ERNE, D. Direct Potentiometric Water Hardness Determination Using Ion-Selective Electrodes, W81-01051 5A
W81-01131 5C CRAWFORD, C. G. A One-Dimensional, Steady-State, Dissolved-Oxygen Model and Waste-load Assimilation	DORE, M. Experimental Assessment of Haloform Reaction Precursors (Etude d'une Methode d'Evaluation Globale des Precurseurs de la Reaction Halo- forme),	FAHEY, T. J. Water Movement Through Stands of Lodgepole Pine Forest in Wyoming, W81-01175 2D
Study for Little Laughery Creek, Ripley and Franklin Counties, Indiana, W81-01025 5B CROWTHER, J. M.	W81-01151 5D DORICH, R. A. Algal Availability of Sediment Phosphorus in Drainage Water of the Black Creek Watershed,	FERREIRA, R. F. Statistical Analyses of Surface-Water-Quality Variables in the Coal Area of Southeastern Mon- tana, W81-01023 5B
A Correlation Method for the Estimation of Retention Times at Full-Scale Sewage Treat- ment Plants, W81-01150 5D	W81-01058 5B DRIOLI, E. Effect of Alcohols on the Mechanical and	FERRONI, G. D. Psychrophiles, Psychrotrophs, and Mesophiles in an Environment which Experiences Seasonal
CRUFF, R. W. Seepage Study of the West Side and West Canals, Box Elder County, Utah,	Transport Properties of Asymmetric Cellulose Acetate Membranes, W81-01148 5D	Temperature Fluctuations, W81-01124 5A FEULNER, A. J.
W81-01026 4A CUMMINGS, S. Chloride Ions in Aqueous Solutions,	Ultrafiltration Processes for Pollution Control and Chemical Reuse in the Tanning Industry, W81-01139 5D	Water-Resources Reconnaissance of the South- eastern Part of St. Paul Island, Pribilof Islands Alaska, W81-01033 4A
W81-01049 1B CUNNIFF, J. G. Plating Waste Treatment, W81-01057 5D	DUCLARY, M. Conception of Plans for a Marseille Purifying Facility. (Conception du Projet de la Station d'Epuration de Marseille), W81-01078 5D	FOX, R. C. Recolonization of Streams by Aquatic Insect Following Channelization, W81-01157 50
D'AURIA, J. M. Mussels (Mytilus Edulis) as 'Point Source' Indi- cators of Trace Metal Pollution, W81-01115 5A	DUNLAP, L. E. Simulated Water-Level Declines Near Mar- ienthal, West-Central Kansas, W81-01030 4B	FRANKOS, N. H. Metal Uptake by Crops Grown Over Entrenched Sewage Sludge, W81-01100 55

FRIESTAD, H. O. Determinations of Trace Amounts of 9,10-Anth-	GRASSHOFF, K.	HAUSER, J. Analysis of Thermal Impact in Tidal Rivers and
raquinone in Aqueous Systems by Differential	In-Situ Registration of Oxygen Utilization at Sediment-Water Interfaces,	Estuaries,
Pulse Polarography, W81-01106 5A	W81-01054 2K	W81-01142 5C
FRITZ, J. S.	GRIFFIN, D. M. JR. Efficient Design of Stormwater Holding Basins	HENRIKSON, L. Predator-Prey Relations Important for the
Concentration and Determination of Organic Acids in Complex Aqueous Samples,	Used for Water Quality Protection, W81-01136 5G	Biotic Changes in Acidified Lakes, W81-01129 5C
W81-01067 5A		
FROST, S.	GRIZZARD, T. J. Efficient Design of Stormwater Holding Basins	HIGHTOWER, G. R. Research and Development on a Spiral-Wound
Changes in Nutrient Ion Level of Substrates and Stream Water Due to Land Management in	Used for Water Quality Protection, W81-01136 5G	Membrane System for Single-Stage Seawater Desalination,
Northumberland, W81-01046 5C	GROVER, K.	W81-01166 3A
FRY, J. C.	Wholesale Water Pricing: A Cost-To-Serve Plan that Works,	HILLIER, D. E. Availability and Quality of Groundwater, South-
The Aquatic Vegetation of Llangorse Lake, Wales,	W81-01104 6C	ern Ute Indian Reservation, Southwestern Colo- rado.
W81-01131 5C	GUARISO, G. A Salt Balance Simulation Model of Lake	W81-01197 5B
FURUTANI, A. Measurement of Mercury Methylation in Lake	Nasser,	Water Resources of Boulder County, Colorado,
Water and Sediment Samples,	W81-01073 2H	W81-01031 5B
W81-01047 5A	GUMMER, W. D. Variability and Loading of Mercury in a Small	HINDAR, A. Effects of Heavy Metals in Combination with
GABRYSCH, R. K. Approximate Altitude of Water Levels in Wells	Prairie River,	NTA, Humic Acid, and Suspended Sediment on
in the Chicot and Evangeline Aquifers in the	W81-01110 5B	Natural Phytoplankton Photosynthesis, W81-01108 5C
Houston Area, Texas, Spring 1979 and Spring	GUNNISON, D.	
1980, W81-01196 2F	A Reaction Chamber for Study of Interactions between Sediments and Water under Conditions	HIRSCH, R. M. An Economic Analysis of Selected Strategies for
GALGOWSKI, C. G.	of Static or Continuous Flow,	Dissolved-Oxygen Management: Chattahoochee
A Variable-Depth Ground-Water Sampler, W81-01088 5A	W81-01137 5B	River, Georgia, W81-01036 5B
	GUPTA, S. K.	HOBROUGH, J. E.
GARRETT, M. E. Improved Wastewater Treatment for Holiday	Designing Irrigation-Cum-Drainage Ponds for Alkali Lands.	Changes in Nutrient Ion Level of Substrates and
Resort Towns on the Coast,	W81-01113 4A	Stream Water Due to Land Management in
W81-01081 5D	HAFKER, W. R.	Northumberland, W81-01046 5C
GARVIS, G. A Well-Head Instrument Package for Multi-Pa-	Development of a Model for Estimating the Extent of River Flooding with Satellite and In	HOEFFNER, S. L.
rameter Measurement during Well Water Sam-	Situ Data,	Influence of Coal Humic Acid on the Growth of
pling, W81-01138 5A	W81-01203 7B	Chlorella Vulgaris Algae, W81-01009 5C
GERBA, C. P.	HAGGARD, J. E. The Columbia River: Protein, Power, Preserva-	HOFFMAN, R. J.
Viruses in Groundwater, W81-01121 5B	tion, and Politics,	Planning and Design of Studies for River-Qual- ity Assessment in the Truckee and Carson River
	W81-01198 6D	Basins, California and Nevada,
GERHART, J. M. Model Evaluation of the Hydrogeology of the	HALL, D. C. Water Resources of Boulder County, Colorado,	W81-01024 6A
Morris Bridge Well Field and Vicinity in West-	W81-01031 5B	HOLJEVIC, S.
Central Florida, W81-01027 6A	HAMLIN, C.	Trace Elements in Water and Biological Sam- ples Determined by X-Ray Spectroscopy,
GIANNI, J.	Sewage: Waste or Resource,	W81-01077 5A
Coincidence of Cadmium and Antibiotic Resist-	W81-01064 5D	HOLM KRISTENSEN, G.
ance in New York Bight Apex Benthic Microor- ganisms,	HANSEN, A. P. Wastewater Characterization in a Multiproduct	Residence Time Distribution in Submerged Bio-
W81-01116 5B	Dairy,	filters, W81-01140 5D
GLUDE, W. J.	W81-01170 5F	HOLMAN, W. F.
Reconnaissance Snow Survey of the National Petroleum Reserve in Alaska, April-May 1979,	HAINSEN, E. A.	Comment,
W81-01187 2C	Irrigation of Intensively Cultured Plantations with Paper Mill Effluent,	W81-01146 5D
GOARD, R.	W81-01094 3C	HOLMES, R. N. Litterfall, Stemflow, and Throughfall Nutrient
Programs Revap and Wevap for Estimating Areal Evapotranspiration and Lake Evaporation		Fluxes in an Alluvial Swamp Forest,
From Climatological Observations,	in-Situ Registration of Oxygen Utilization at	W81-01065 5B
W81-01017 2D	Sediment-Water Interfaces, W81-01054 2K	HONGVE, D.
GOICHON, J.	HARDT, W. F.	Effects of Heavy Metals in Combination with NTA, Humic Acid, and Suspended Sediment on
Experimental Assessment of Haloform Reaction Precursors (Etude d'une Methode d'Evaluation Globale des Precurseurs de la Reaction Halo	Development and Use of a Mathematical Model of the San Bernardino Valley Ground-Water	Natural Phytoplankton Photosynthesis,
forme),	Basin, California,	HORN, R.
W81-01151 5D		Sand Cambisol Functioning as a Filter through Long-Term Irrigation with Wastewater,
GRANEY, R. L. Asiatic Clam Invasion: Causes and Effects,	HARING, B. J. A. Corrosiveness of Drinking Water and Cardio-	
W81-01173 50	vascular Disease Mortality,	HORWOOD W. C.
GRASON, D.	W81-01109 3F	Program Layout - An Interactive Program to
Water-Quality Monitoring of Three Major Tri butaries to the Chesapeake BayInterim Data		Handle Page Layout for Documentation of Computer Files Printed on-Line at Remote Ter
Report,	filters,	minals,
W81-01184 7C	W81-01140 5D	W81-01015 7E

HOWE, R. A.

HOWE, R. A. Chloride Ions in Aqueous Solutions, W81-01049 1B	Viruses in Groundwater, W81-01121 5B	LIEBEZEIT, G. The Monosaccharide Spectra of Natural Waters, W81-01053
HOYAUX, B.	KLUTE, A.	LIMBURG, P. L.
Conception of Plans for a Marseille Purifying Facility. (Conception du Projet de la Station d'Epuration de Marseille),	Application of Sewage Effluent to Columns of a Mountain Meadow Soil: I. Errors in Calculating the Transport of Ionic Salts,	Desalination/Power Cycles with the Biphase Rotary Separator and Turbine, W81-01165 3A
W81-01078 5D	W81-01090 3C	LISLE, I.
HUDSON, J. D. Ground-Water Levels in New Mexico, 1977, W81-01181 7C	KNAPTON, J. R. Statistical Analyses of Surface-Water-Quality Variables in the Coal Area of Southeastern Mon-	Third-Order Integral Relation Between Sorpti- vity and Soil Water Diffusivity Using Brutsaert's Technique,
HUNTER, J. V.	tana, W81-01023 5B	W81-01076 2G
Input into and Fate of Lead in a Small Reser-	KNIGHT, D. H.	LITCHFIELD, C. D. Coincidence of Cadmium and Antibiotic Resist-
voir, W81-01045 5B	Water Movement Through Stands of Lodgepole Pine Forest in Wyoming,	ance in New York Bight Apex Benthic Microorganisms,
HUTCHINSON, C. B. Development and Use of a Mathematical Model	W81-01175 2D	W81-01116 5B
of the San Bernardino Valley Ground-Water	KNUCKLES, M. E. Interactions and Survival of Enteric Viruses in	LIU, D. Enhancement of PCBS Biodegradation by
Basin, California, W81-01186 2F	Soil Materials,	Sodium Ligninsulfonate,
	W81-01171 5B	W81-01133 5D
HUTCHINSON, E. C. Availability and Quality of Groundwater, Southern Ute Indian Reservation, Southwestern Colo-	KOLARIK, L. O. Colour and Turbidity Removal with Reusable	LJUBICIC, A. Trace Elements in Water and Biological Sam-
rado, W81-01197 5B	Magnetic Particles-II. Coagulation with Magnet- ic Polymer Composites,	ples Determined by X-Ray Spectroscopy, W81-01077 5A
	W81-01141 5F	LONGMORE, A. R.
IRVINE, R. L. Storage-Induced Denitrification Using Sequencing Batch Reactor Operation,	KRAMER, C. A Salt Balance Simulation Model of Lake	Behaviour of Phosphate in Estuarine Water, W81-01050 5B
W81-01132 5D	Nasser, W81-01073 2H	LUCAS, S.
ITTEKKOT, V.	KRUG, P.	Conservation V. Land Drainage - A Guide for the Future,
The Monosaccharide Spectra of Natural Waters, W81-01053 2K	Input into and Fate of Lead in a Small Reser-	W81-01048 6A
JANARDAN, K. G.	voir, W81-01045 5B	LUCHTEL, D. L.
Efficiencies of Liquid-Liquid Extraction and XAD-4 and XAD-7 Resins in Collecting Organ-	LACROIX, G. Conception of Plans for a Marseille Purifying	Electron Microscopy of Giardia Lamblia Cysts, W81-01059 5F
ic Compounds from a Coke Plant's Effluent, W81-01112 5A	Facility. (Conception du Projet de la Station d'Epuration de Marseille),	LUZIER, J. E. Digital-Simulation and Projection of Head
JAYAKODY, A. N.	W81-01078 5D	Changes in the Potomac-Raritan-Magothy
Sand Cambisol Functioning as a Filter through Long-Term Irrigation with Wastewater,	LAGANA, A.	Aquifer System, Coastal Plain, New Jersey, W81-01185 2F
W81-01130 5D	Concentration and Determination of Polycyclic Aromatic Hydrocarbons in Aqueous Samples on	LYONS, C. R.
JAYNES, D. B.	Graphitized Carbon Black, W81-01068 5A	Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater
Comparison of One-Step Outflow Laboratory Method to an in Situ Method for Measuring		Desalination,
Hydraulic Conductivity,	LAMB, T. E. Water-Quality Investigation of the Caney Creek	W81-01166 3A
W81-01092 2G	Watershed, Northeast Arkansas,	Research and Development on a Spiral-Wound
JOHNSON, D. C.	W81-01189 6A	Membrane System for Single-Stage Seawater Deslination.
Mussels (Mytilus Edulis) as 'Point Source' Indi- cators of Trace Metal Pollution,	LANG, D. J.	W81-01167 3A
W81-01115 5A	Water-Quality Monitoring of Three Major Tri- butaries to the Chesapeake BayInterim Data	MACCARY, L. M.
JOHNSON, D. M.	Report,	Use of Geophysical Logs to Estimate Water-
Model Evaluation of the Hydrogeology of the	W81-01184 7C	Quality Trends in Carbonate Aquifers, W81-01029 7B
Morris Bridge Well Field and Vicinity in West- Central Florida,	LARSEN, J. Offshore Water Intakes Designed to Protect	MANAHAN, S. E.
W81-01027 6A	Fish,	Influence of Coal Humic Acid on the Growth of
JOHNSON, M. J.	W81-01070 6G	Chlorella Vulgaris Algae, W81-01009 5C
Geology and Ground Water in North-Central	LAWRENCE, W. P.	
Santa Cruz County, California, W81-01044 7C	Electron Microscopy of Giardia Lamblia Cysts, W81-01059 5F	MARTIN, M. V. Navigation as an Alternative Use,
JONES, M. L.	LEACH, G. J.	W81-01202 6B
Sediment Transport in the Snake and Clearwater	The Role of Cortisol in Stress-Induced Metabol-	MAYO, R. I.
Rivers in the Vicinity of Lewiston, Idaho, W81-01037 2J	ic Changes in Fundulus Heteroclitus, W81-01007 5C	Flood of June 18, 1978, on Honey Creek Tribu- tary at Thornville, Ohio,
JONES, V. A.	LEE, R. W.	W81-01194 2E
Wastewater Characterization in a Multiproduct	Geochemistry of Water in the Fort Union For- mation of the Northern Powder River Basin.	MCCARTY, P. L.
Dairy, W81-01170 5F	Southeastern Montana,	Evaluation of Steady-State-Biofilm Kinetics, W81-01125 5A
KAMINSKI, J. S.	W81-01041 5B	MCCLEAN, C.
Psychrophiles, Psychrotrophs, and Mesophiles	LESTER, J. N.	Coincidence of Cadmium and Antibiotic Resist-
in an Environment which Experiences Seasonal Temperature Fluctuations.	Response to Comments by A. P. Walker, W. F. Holman and R. H. Wendt.	ance in New York Bight Apex Benthic Microor- ganisms.
W81_01124 SA	W81-01147 SD	ganisms, W81-01116

MCINTOSH, A. W. Input into and Fate of Lead in a Small Reservoir.	MORRIS, D. Made to Measure, W81-01074 8A	NYMAN, G. Predator-Prey Relations Important for the Biotic Changes in Acidified Lakes.
W81-01045 5B	MORTON, F. I.	W81-01129 5C
MCKENZIE, S. W. Water Quality of Bear Creek Basin, Jackson County, Oregon, W81-01032 5A	Programs Revap and Wevap for Estimating Areal Evapotranspiration and Lake Evaporation From Climatological Observations, W81-01017 2D	O'CONNOR, D. J. The Effect of Concentration of Adsorbing Solids on the Partition Coefficient, W81-01144 5B
MCLEESTER, J. N. Development of a Model for Estimating the Extent of River Flooding with Satellite and In Situ Data.	MOULTON, R. Concern Over the Columbia Estuary, W81-01011 6E	O'CONNOR, G. A. Using Saline Water for Crop Production in New Mexico, W81-01156 3C
W81-01203 7B MEIER, P. C.	MUCKLESTON, K. W. International Management of the Columbia, W81-01201 6E	OAKLEY, S. M. Kinetics of Trace Metal Partitioning in Model
Direct Potentiometric Water Hardness Determi- nation Using Ion-Selective Electrodes, W81-01051 5A	MURRAY, C. M. Metal Uptake by Crops Grown Over Entrenched Sewage Sludge,	Anoxic Marine Sediments, W81-01154 5B OBERMILLER, F. W.
MESHREF, H. Sand Cambisol Functioning as a Filter through Long-Term Irrigation with Wastewater,	W81-01100 5E MUSSALLI, Y. G. Offshore Water Intakes Designed to Protect	Agriculture and Hydro-Power: Costs, Benefits, and Trade-Offs, W81-01199 6B
W81-01130 5D MEYER, M. A.	Fish, W81-01070 6G	OGATA, M. Gas Chromatography Combined with Mass Spectrometry for the Identification of Organic
Changes in the Zooplankton of Onondaga Lake (NY), 1969-1978, W81-01122 5C	NARAIN, P. Effect of the Salinity of Irrigation Water on Wheat Yield and Soil Properties, W81-01114 3C	Sulfur Compounds in Shellfish and Fish, W81-01123 5C
MIDGLEY, D. Chlorine Disappearance in Sea Water, W81-01143 5F	NASH, G. P. Aerial Infrared Photography for Flood Plain Investigations,	OKUN, D. A. Philosophy of the Safe Drinking Water Act and Potable Reuse, W81-01120 5D
MILLER, G. C. Photolysis of 3,4-Dichloroaniline in Natural Waters, W81-01101 5A	W81-0Ĭ055 7B NEBOLSINE, R. New Concepts for the Treatment of Sewage Discharged to the Sea,	ORCHARD, V. A. Long Term Effect of Sewage Sludge Additions on Populations of Nocardia Asteroides, Micromonospora and Thermoactinomyces in Soil, W81-01061
MILLER, J. Determination of the Aqueous Solubilities of Organic Liquids at 10.0, 20.0, and 30.0 C by Elution Chromatography, W81-01127 5A	W81-01080 5D NEILSON, G. W. Chloride Ions in Aqueous Solutions, W81-01049 1B	ORLIC, I. Trace Elements in Water and Biological Samples Determined by X-Ray Spectroscopy, W81-01077 5A
MILLER, W. L. Geologic Aspects of the Surficial Aquifer in the Upper East Coast Planning Area, Southeast Florida,	NELSON, D. W. Algal Availability of Sediment Phosphorus in Drainage Water of the Black Creek Watershed, W81-01058 5B	OSCARSON, H. G. Predator-Prey Relations Important for the Biotic Changes in Acidified Lakes, W81-01129 5C
W81-01038 4B MILSTEAD, C. E.	NELSON, P. O. Kinetics of Trace Metal Partitioning in Model Anoxic Marine Sediments,	PABST, M. E. Maps Showing Saturated Thickness, January 1979, and Percentage Decrease in Saturated
Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater Desalination, W81-01166 3A	W81-01154 5B NELSON, R. E. New Ways to Fix Leaky Sewers,	Thickness, 1950-79, of Unconsolidated Aquifer West-Central, Kansas, W81-01195
	W81-01102 8A	PAKALNS, P.
Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater Deslination, W81-01167 3A	NEWSOM, G. Water-Quality Investigation of the Caney Creek Watershed, Northeast Arkansas, W81-01189 6A	The Effect of Surfactants, Cations, and Complexing Agents on the Spectrophotometric Determination of Microgram Amounts of Uranium in Waters,
MITCHELL, J. K. Costs and Benefits of Terraces for Erosion Control,	NEWSOME, J. R. Chloride Ions in Aqueous Solutions,	W81-01052 5A PANDEY, R. N.
W81-01062 4D	W81-01049 1B NICOLAIS, L.	Designing Irrigation-Cum-Drainage Ponds for Alkali Lands,
MIYAKE, Y. Gas Chromatography Combined with Mass Spectrometry for the Identification of Organic Sulfur Compounds in Shellfish and Fish, W81-01123 5C	Effect of Alcohols on the Mechanical and Transport Properties of Asymmetric Cellulose Acetate Membranes, W81-01148 5D	W81-01113 4A PARLANGE, J-Y. Third-Order Integral Relation Between Sorptivity and Soil Water Diffusivity Using Brutsaert
MIYAMOTO, S. Effects of Bicarbonate on Sodium Hazard of	NILSSON, B-I. Predator-Prey Relations Important for the Biotic Changes in Acidified Lakes,	Technique, W81-01076 2C PARSONS, J. E.
Irrigation Water: Alternative Formulation, W81-01089 2G	W81-01129 5C NORRIS, D. F.	Translocation of Mercury and Microbial Adaptation in a Model Aquatic System, W81-01174 51
MOORE, J. W. Seasonal and Species-Dependent Variability in the Biological Impact of Mine Wastes in an	Solids-Contact Clarification Brings Out Best of Trickling Filters, W81-01097 5D	PEEBLES, R. W. Water Usage Patterns in the U.S. Virgin Islands
Alpine River, W81-01111 5C	NOWLIN, J. O.	W81-01005 6E
MOPPER, K. The Monosaccharide Spectra of Natural Waters, W81-01053	Planning and Design of Studies for River-Qual- ity Assessment in the Truckee and Carson River Basins, California and Nevada, W81-01024 6A	PERRY, R. Response to Comments by A. P. Walker, W. F. Holman and R. H. Wendt. W81-01147 51

PETERS, J. G.	in the Flood Plains of Southeastern U.S. Coastal	SCHAEFFER, D. J.
A One-Dimensional, Steady-State, Dissolved- Oxygen Model and Waste-load Assimilation	Streams, W81-01158 5A	Efficiencies of Liquid-Liquid Extraction and XAD-4 and XAD-7 Resins in Collecting Organ-
Study for Little Laughery Creek, Ripley and Franklin Counties, Indiana,	RICH, P. H. Hypolimnetic Metabolism in Three Cape Cod	ic Compounds from a Coke Plant's Effluent, W81-01112 5A
W81-01025 5B	Lakes,	SCHEFTER, J. E.
PETERSEN, J. In-Situ Registration of Oxygen Utilization at	W81-01128 2H	An Economic Analysis of Selected Strategies for Dissolved-Oxygen Management: Chattahoochee
Sediment-Water Interfaces, W81-01054 2K	RICHARD, J. J. Concentration and Determination of Organic Acids in Complex Aqueous Samples,	River, Georgia, W81-01036 5B
PETKE, D. L. Water Quality of the Columbia River, W81-01200 5C	W81-01067 5A RICKARD, D. G. Rehabilitation of the Inner Thames Estuary,	SCHREIER, H. Asbestos Fibres in Receiving Waters, W81-01013 5A
PETRONIO, B. M. Concentration and Determination of Polycyclic Aromatic Hydrocarbons in Aqueous Samples on	W81-01118 5C RIEMER, M.	SCHRODER, K. H. Determinations of Trace Amounts of 9,10-Anthraquinone in Aqueous Systems by Differential
Graphitized Carbon Black, W81-01068 5A	Residence Time Distribution in Submerged Bio- filters, W81-01140 5D	Pulse Polarography, W81-01106 5A
PFISTER, R. M.	RILEY, R. L.	SCHWARZ, F. P.
Translocation of Mercury and Microbial Adaptation in a Model Aquatic System, W81-01174 5B	Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater Desalination,	Determination of the Aqueous Solubilities of Organic Liquids at 10.0, 20.0, and 30.0 C by Elution Chromatography, W81-01127 5A
PHILIPSON, W. R. Development of a Model for Estimating the	W81-01166 3A	SEITZ, H. R.
Extent of River Flooding with Satellite and In Situ Data, W81-01203 7B	Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater Deslination, W81-01167 3A	Sediment Transport in the Snake and Clearwater Rivers in the Vicinity of Lewiston, Idaho, W81-01037 2J
PIERSON, H. G. W.	RIMA, D. R.	SEROY, M. W.
Sludge Dewatering, W81-01071 5D PIWOWAR, J.	Susceptibility of the Memphis Water Supply to Contamination from the Pesticide Waste Dispos- al Site in Northeastern Hardeman County, Ten-	Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater Desalination,
Programs Revap and Wevap for Estimating Areal Evapotranspiration and Lake Evaporation	nessee, W81-01192 5B	W81-01166 3A Research and Development on a Spiral-Wound
From Climatological Observations, W81-01017 2D	RINELLA, J. F. Lakes of Oregon: Volume 6. Douglas County,	Membrane System for Single-Stage Seawater Deslination, W81-01167 3A
POPHAM, J. D. Mussels (Mytilus Edulis) as 'Point Source' Indi-	W81-01043 2H	
cators of Trace Metal Pollution, W81-01115 5A	RITTMANN, B. E. Evaluation of Steady-State-Biofilm Kinetics, W81-01125 5A	SHELLEY, P. E. Automatic Sewage Samplers: What to Look for When Buying,
PORTERFIELD, G. Sediment Transport of Streams Tributary to San	ROBINSON, P. E.	W81-01103 5A
Francisco, San Pablo, and Suisun Bays, California, 1909-66,	Hydraulic Efficiency of Wastewater Lagoon Systems, W81-01093 5D	SHERRARD, J. H. Activated Sludge Wastewater TreatmentStoi- chiometric Relationships,
W81-01034 2J	ROSS, P. P.	W81-01105 5D
PRESTON, K. M. A Reaction Chamber for Study of Interactions between Sediments and Water under Conditions of Static or Continuous Flow,	Simulated Effects of a Proposed Well Field on the Groundwater System in the Salt River Indian Reservation, Maricopa County, Arizona, W81-01191 2F	SHORT, R. A. Detrital Processing and Associated Macroinver- tebrates in a Colorado Mountain Stream, W81-01066 5B
W81-01137 5B	ROTATORI, M.	SIKORA, L. J.
QUINLAN, A. V. The Thermal Sensitivity of Nitrification as a Function of the Concentration of Nitrogen Sub-	Concentration and Determination of Polycyclic Aromatic Hydrocarbons in Aqueous Samples on Graphitized Carbon Black,	Metal Uptake by Crops Grown Over En- trenched Sewage Sludge, W81-01100 5E
strate, W81-01145 5D	W8Î-01068 5A	SIMMONS, C. E.
RAMADORI, R. An Automated System for Monitoring the Kinetics of Biological Oxidation of Ammonia,	ROZZI, A. An Automated System for Monitoring the Kinetics of Biological Oxidation of Ammonia,	Quality of Water in the Black River Near Dunn, North Carolina, and Ground-Water Levels Ad- jacent to the River Prior to Channel Excavation in 1976-79.
W81-01135 SB	W81-01135 5B	W81-01193 6A
RANDALL, C. Efficient Design of Stormwater Holding Basins Used for Water Quality Protection, W81-01136 5G	RUDD, J. W. M. Measurement of Mercury Methylation in Lake Water and Sediment Samples, W81-01047 5A	SIMON, W. Direct Potentiometric Water Hardness Determination Using Ion-Selective Electrodes, W81-01051 5A
RANEY, D. C.	RYDER, P. D. Model Evaluation of the Hydrogeology of the	
Predicting the Effects of Storm Surges and Abnormal River Flow on Flooding and Water Movement in Mobile Bay, Alabama, W81-01008	Model Evaluation of the Hydrogeology of the Morris Bridge Well Field and Vicinity in West- Central Florida, W81-01027 6A	SINGH, B. Effect of the Salinity of Irrigation Water on Wheat Yield and Soil Properties, W81-01114 3C
RENN, D. E.	SABEY, B. R.	SKOGHEIM, O. K. Effects of Heavy Metals in Combination with
Water-Quality Assessment of the Porter County Watershed, Kankakee River Basin, Porter County, Indiana,	Application of Sewage Effluent to Columns of a Mountain Meadow Soil: I. Errors in Calculating the Transport of Ionic Salts, W81-01090 3C	NTA, Humic Acid, and Suspended Sediment on Natural Phytoplankton Photosynthesis, W81-01108
W81-01035 5B	SANKS, R. L.	SLOAN, C. E.
REUTER, J. H. Chemical and Spectroscopic Characterization of Humic Substances Derived from River Swamps	Wastewater Treatment Process Evaluated by Force Account, W81-01086 6B	Reconnaissance Snow Survey of the National Petroleum Reserve in Alaska. April-May 1979, W81-01187 2C

SMART, R. B. Differential Pulse Anodic Stripping Voltam-	TACKE, J. W. Wastewater Treatment Process Evaluated by	UPDIKE, J. Flow Equalize All Influent,
metry of Copper(II) at the Glassy Carbon Elec- trode,	Force Account, W81-01086 6B	W81-01119 5D
W81-01010 5A	TAFT, E. P.	VALKOVIC, V. Trace Elements in Water and Biological Sam-
SMITH, H. H. Water Usage Patterns in the U.S. Virgin Islands,	Offshore Water Intakes Designed to Protect Fish,	ples Determined by X-Ray Spectroscopy, W81-01077 5A
W81-01005 6D	W81-01070 6G	VAN GENUCHTEN, M. T.
SMITH, I. JR.	TAGAMI, M.	A Closed-Form Equation for Predicting the Hy-
A Reaction Chamber for Study of Interactions between Sediments and Water under Conditions	Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater	draulic Conductivity of Unsaturated Soils, W81-01087 2G
of Static or Continuous Flow, W81-01137 5B	Deslination, W81-01167 3A	VERTREES, R. L. Five-Year Water Resources Research and De-
SMITH, J. D.	TALLING, J. F.	velopment Plan, Fiscal Years 1982-1986,
Behaviour of Phosphate in Estuarine Water, W81-01050 5B	Some Problems of Aquatic Environments in Egypt from a General Viewpoint of Nile Ecol-	W81-01164 6E
	ogy,	WAGNER, R. A. Interactions and Survival of Enteric Viruses in
SMITH, L. H. Planning and Design of Studies for River-Qual-	W81-01072 5C	Soil Materials,
ity Assessment in the Truckee and Carson River	TANDOI, V.	W81-01171 5B
Basins, California and Nevada,	An Automated System for Monitoring the Ki- netics of Biological Oxidation of Ammonia,	WALKER, A. P.
W81-01024 6A	W81-01135 5B	Comment,
SNAVELY, D. S.		W81-01146 5D
Ground-Water Appraisal of the Fishkill-Beacon	TANZER, F. Analysis of Thermal Impact in Tidal Rivers and	WALSH, J.
Area, Dutchess County, New York, W81-01028 2F	Estuaries, W81-01142 5C	What to do When the Well Runs Dry, W81-01060 3F
SNELL, L. J.		
Hydrologic Investigations in the Araguaia-To-	TAYLOR, J. Asbestos Fibres in Receiving Waters,	WARD, J. V. Detrital Processing and Associated Macroinver-
cantins River Basin (Brazil),	W81-01013 5A	tebrates in a Colorado Mountain Stream,
W81-01188 7A	TAYLOR, M. H.	W81-01066 5B
SOBSEY, M. D.	The Role of Cortisol in Stress-Induced Metabol-	WARN, A. E.
Interactions and Survival of Enteric Viruses in	ic Changes in Fundulus Heteroclitus,	Mass Balance,
Soil Materials, W81-01171 5B	W81-01007 5C	W81-01134 5B
W81-01171 5B	TCHOBANOGLOUS, G.	WEBBER, E. E.
SOMANI, S. M.	Effective Wastewater Management Planning for	Flood of June 18, 1978, on Honey Creek Tribu-
Efficiencies of Liquid-Liquid Extraction and XAD-4 and XAD-7 Resins in Collecting Organ-	Sinall Communities - Part 2, W81-01083 6E	tary at Thornville, Ohio, W81-01194 2E
ic Compounds from a Coke Plant's Effluent,		W81-01194 2E
W81-01112 5A	THURLEY, S. S. The Aquatic Vegetation of Llangorse Lake,	WEBER, J. H.
SOMMERS, L. E.	Wales,	Differential Pulse Anodic Stripping Voltam- metry of Copper(II) at the Glassy Carbon Elec-
Algal Availability of Sediment Phosphorus in	W81-01131 5C	trode,
Drainage Water of the Black Creek Watershed,	TIGWELL, D. C.	W81-01010 5A
W81-01058 5B	Efficiencies of Liquid-Liquid Extraction and	WELLERS, J.
SOROOS, R. L.	XAD-4 and XAD-7 Resins in Collecting Organ-	Land Use. Pigs in Pokes: Pork Barrel Water
Test Monitoring of Prototype Injection Well,	ic Compounds from a Coke Plant's Effluent, W81-01112 5A	Projects,
Waiale, Maui, Hawaii, W81-01190 6A		W81-01063 5C
	TILLMAN, D. C. Los Angeles to Meet Regs with Energy-Miser	WENDT, R. H.
STIEFEL, R. C.	Sludge Processor,	Comment,
Five-Year Water Resources Research and Development Plan, Fiscal Years 1982-1986,	W81-01152 5D	W81-01146 5D
W81-01164 6E	TITUS, J. A.	WESTGATE, J. T.
STOVELAND, S.	Translocation of Mercury and Microbial Adap-	Design of Objective Functions for Reservoir Operations,
Response to Comments by A. P. Walker, W. F.	tation in a Model Aquatic System,	W81-01169 6B
Holman and R. H. Wendt,	W81-01174 5B	WEYER, K. U.
W81-01147 5D	TOBIASON, J. E.	Program Layout - An Interactive Program to
STUERMER, D. H.	Packed Bed Filtration: Experimental Investiga- tion and Conceptual Analysis of Filter Ripening	Handle Page Layout for Documentation of
A Well-Head Instrument Package for Multi-Pa-	Model,	Computer Files Printed on-Line at Remote Ter-
rameter Measurement during Well Water Sam- pling,	W81-01168 5D	minals, W81-01015 7B
W81-01138 5A	TOLSTED, D. N.	
CUDATE A D. I	Irrigation of Intensively Cultured Plantations	WHITE, T. R. Recolonization of Streams by Aquatic Insects
SUPALLA, R. J. An Economic Evaluation of the Feasibility of	with Paper Mill Effluent,	Following Channelization,
Artificial GroundWater Recharge in Nebraska,	W81-01094 3C	W81-01157 5C
W81-01155 6B	TOWNLEY, J. M.	WHITTINGTON, D.
SWANSON, E. R.	The Orr Ditch Case, 1913-1944, W81-01161 6E	A Salt Balance Simulation Model of Lake
Costs and Benefits of Terraces for Erosion Con-		Nasser,
trol, W81-01062 4D	The Truckee Basin Fishery, 1844-1944, W81-01162 5C	W81-01073 2H
W81-01062 4D		WILBER, W. G.
SWINTON, E. A.	TYLER, E. J.	A One-Dimensional, Steady-State, Dissolved-
Colour and Turbidity Removal with Reusable Magnetic Particles-II. Coagulation with Magnet-	Comparison of One-Step Outflow Laboratory Method to an in Situ Method for Measuring	Oxygen Model and Waste-load Assimilation Study for Little Laughery Creek. Ripley and
ic Polymer Composites,	Hydraulic Conductivity,	Franklin Counties, Indiana.
W81-01141 5F	W81-01092 2G	W81-01025 5B

AUTHOR INDEX

WILLIAMSON, K. J.

WILLIAMSON, K. J.	
Kinetics of Trace Metal Partitioning	in Model
Anoxic Marine Sediments,	
W81-01154	5B
WITTENBERG, L. A.	
Water Quality of Bear Creek Basin	, Jackson
County, Oregon,	
W81-01032	5A
WONG, M. H.	
Different Methods to Extract Sewage	Sludge for
the Cultivation of Chlorella Pyrenoido	
W81-01069	5D
WOODHEAD, T.	
A Correlation Method for the Esti	mation of
Retention Times at Full-Scale Sews	
ment Plants.	ge riem
W81-01150	5D
***************************************	02
WRIGHT, W. R.	
A Variable-Depth Ground-Water Sam	pler.
W81-01088	5A
YAMANAKA, S. T. JR.	
Advanced Primary Treatment for C	cean Dis-
charge,	
W81-01079	5D
YOUNG, F. R.	
Fish Management and Protection,	
W81-01012	81
ZEPP, R.	
Photolysis of 3,4-Dichloroaniline i	n Natural
Waters,	
W81-01101	5A
ZISOOK, R.	
Photolysis of 3,4-Dichloroaniline i	n Natural
Waters.	
W81-01101	5A
ZOETEMAN, B. C. J.	
	nd Cardio
Corrosiveness of Drinking Water as	nd Cardio-
	nd Cardio-

1

ACADEMY OF SCIENTIFIC RESEARCH AND	CALIFORNIA UNIV., LIVERMORE.	CONNECTICUT UNIV., STORRS.
TECHNOLOGY, CAIRO (EGYPT).	ENVIRONMENTAL SCIENCES DIV. A Well-Head Instrument Package for Multi-Pa-	BIOLOGICAL SCIENCES GROUP.
A Salt Balance Simulation Model of Lake		Hypolimnetic Metabolism in Three Cape Cod
Nasser,	rameter Measurement during Well Water Sam-	Lakes,
W81-01073 2H	pling, W81-01138 5A	W81-01128 2H
AT ADAMA TIMES TRUSTED COPER		CONCICUO NAZIONALE DELLE
ALABAMA UNIV., UNIVERSITY.	CANADA CENTER FOR INLAND WATERS.	CONSIGLIO NAZIONALE DELLE
Predicting the Effects of Storm Surges and Ab-	BURLINGTON (ONTARIO).	RICERCHE, ROME (ITALY). INST. FOR
normal River Flow on Flooding and Water	Interlaboratory Quality Control Study No. 24,	WATER RESEARCH.
Movement in Mobile Bay, Alabama,	Analysis of Eight Acid Herbicides in Natural	An Automated System for Monitoring the Ki-
W81-01008 2E	Fresh Water,	netics of Biological Oxidation of Ammonia,
	W81-01016 5A	W81-01135 5B
ALBERTA ENVIRONMENTAL CENTER,	W01-01010 3A	
VEGREVILLE,	CANADA CENTRE FOR INLAND WATERS,	CORNELL UNIV., ITHACA, NY. SCHOOL OF
Seasonal and Species-Dependent Variability in	BURLINGTON (ONTARIO),	CIVIL AND ENVIRONMENTAL
the Biological Impact of Mine Wastes in an		ENGINEERING.
Alpine River,	St. Lawrence River Water Quality Surveys,	Development of a Model for Estimating the
W81-01111 5C	1977, W81-01014 5B	Extent of River Flooding with Satellite and In
W61-01111	W01-01014 JB	Situ Data.
AMEC LAD IA	CARIBBEAN RESEARCH INST., ST. THOMAS	W81-01203 7B
AMES LAB., IA.	(VIRGIN ISLANDS). WATER RESOURCES	75
Concentration and Determination of Organic		DELAWARE UNIV., LEWES, MARINE
Acids in Complex Aqueous Samples,	RESEARCH CENTER. Water Usage Patterns in the U.S. Virgin Islands,	
W81-01067 5A		STUDIES COMPLEX.
	W81-01005 6D	The Monosaccharide Spectra of Natural Waters,
ANDERSEN (ARTHUR) AND CO.,	CENTER AT THE COMPLETE OF STREET	W81-01053 2K
HARTFORD, CT.	CENTRAL ELECTRICITY GENERATING	
Management Audits for the 80's,	BOARD, LEATHERHEAD (ENGLAND).	DELAWARE UNIV., NEWARK. SCHOOL OF
W81-01098 6E	CENTRAL ELECTRICITY RESEARCH LABS.	LIFE AND HEALTH SCIENCES.
	Chlorine Disappearance in Sea Water,	The Role of Cortisol in Stress-Induced Metabol-
ANGLIAN WATER AUTHORITY,	W81-01143 5F	ic Changes in Fundulus Heteroclitus,
		W81-01007 5C
HUNTINGDON (ENGLAND). DIRECTORATE OF RESOURCE PLANNING.	CENTRAL SOIL SALINITY RESEARCH	
	INST., KARNAL (INDIA).	DELAWARE UNIV., NEWARK, WATER
Mass Balance,	Designing Irrigation-Cum-Drainage Ponds for	RESOURCES CENTER.
W81-01134 5B	Alkali Lands,	Planning for Fiscal Years 1982/1986.
	W81-01113 4A	W81-01163 6E
ARIZONA WATER RESOURCES RESEARCH		W01-01103
CENTER, TUCSON.	CENTRE D'OCEANOGRAPHIE, MARSEILLE	DEPARTMENT OF FISHERIES AND
The Use of the Compartmented Reservoir in	(FRANCE). STATION MARINE D'ENDOUME.	
Water Harvesting Agrisystems,	Relationship of Pollution to Rocky Substratum	OCEANS, WINNIPEG (MANITOBA).
W81-01022 3B	Polychaetes on the French Mediterranean Coast,	FRESHWATER INST.
	W81-01099 5A	Measurement of Mercury Methylation in Lake
ARMY ENGINEER WATERWAYS		Water and Sediment Samples,
EXPERIMENT STATION, VICKSBURG, MS.	CH2M/HILL, REDDING CA.	W81-01047 5A
ENVIRONMENTAL LAB,	Low-Cost Filter System Meets Drinking Water	
A Reaction Chamber for Study of Interactions	Standards,	DEPARTMENT OF SCIENTIFIC AND
between Sediments and Water under Conditions	W81-01084 5F	INDUSTRIAL RESEARCH, LOWER HUTT
		(NEW ZEALAND), SOIL BUREAU,
of Static or Continuous Flow,	CHINESE UNIV. OF HONG KONG, SHATIN.	Long Term Effect of Sewage Sludge Additions
W81-01137 5B	DEPT. OF BIOLOGY.	on Populations of Nocardia Asteroides, Micro
	Different Methods to Extract Sewage Sludge for	monospora and Thermoactinomyces in Soil,
AUSTRALIAN ATOMIC ENERGY	the Cultivation of Chlorella Pyrenoidosa,	W81-01061 50
COMMISSION RESEARCH	W81-01069 5D	
ESTABLISHMENT, LUCAS HEIGHTS.		DEPARTMENT OF THE ENVIRONMENT,
The Effect of Surfactants, Cations, and Com-	CLEMSON UNIV., SC. DEPT. OF	VANCOUVER (BRITISH COLUMBIA).
plexing Agents on the Spectrophotometric De-	ENTOMOLOGY AND ECONOMIC	PACIFIC REGION.
termination of Microgram Amounts of Uranium	ZOOLOGY.	
in Waters,	Recolonization of Streams by Aquatic Insects	Asbestos Fibres in Receiving Waters,
W81-01052 5A	Following Channelization,	W81-01013 5A
	W81-01157 5C	
BAYLOR COLL. OF MEDICINE, HOUSTON,		EAST CAROLINA UNIV., GREENVILLE, NC.
TX.	COLORADO STATE UNIV., FORT COLLINS.	DEPT. OF BIOLOGY.
Viruses in Groundwater,	DEPT. OF AGRONOMY.	Litterfall, Stemflow, and Throughfall Nutrien
	Application of Sewage Effluent to Columns of a	Fluxes in an Alluvial Swamp Forest,
W81-01121 5B	Mountain Meadow Soil: I. Errors in Calculating	W81-01065 51
DIDITACE ENERGY CUCTERSO CARTE	the Transport of Ionic Salts,	
BIPHASE ENERGY SYSTEMS, SANTA	W81-01090 3C	EG AND G WASHINGTON ANALYTICAL
MONICA, CA.		SERVICES CENTER, INC., ROCKVILLE, MD.
Desalination/Power Cycles with the Biphase	COLORADO STATE UNIV., FORT COLLINS.	Automatic Sewage Samplers: What to Look for
Rotary Separator and Turbine,	DEPT. OF CIVIL ENGINEERING.	When Buying,
W81-01165 3A	Design of Objective Functions for Reservoir	W81-01103 5/
	Operations,	
BRISTOL UNIV. (ENGLAND). H. H. WILLS	W81-01169 6B	EIDGENOESSISCHE TECHNISCHE
PHYSICS LAB.	COLOR IDO CELER LATER COLOR COLOR	HOCHSCHULE, ZURICH (SWITZERLAND).
Chloride Ions in Aqueous Solutions,	COLORADO STATE UNIV., FORT COLLINS.	DEPT. OF ORGANIC CHEMISTRY.
W81-01049 1B	DEPT. OF ZOOLOGY AND ENTOMOLOGY.	Direct Potentiometric Water Hardness Determ
	Detrital Processing and Associated Macroinver-	nation Using Ion-Selective Electrodes,
BROWN AND CALDWELL, EUGENE, OR.	tebrates in a Colorado Mountain Stream,	W81-01051 5/
Solids-Contact Clarification Brings Out Best of	W81-01066 5B	W 81*01031
Trickling Filters,		PANUIDEV INC. WALIVECUA WI
	COMMONWEALTH SCIENTIFIC AND	ENVIREX INC., WAUKESHA, WI.
W81-01097 5D	INDUSTRIAL RESEARCH ORGANIZATION,	Digester Methane Utilization Can be Optimized
CATTRONIUS INNIU CATTRONIUS CO	SOUTH MELBOURNE (AUSTRALIA). DIV.	W81-01095 51
CALIFORNIA UNIV., DAVIS. DEPT. OF	OF CHEMICAL TECHNOLOGY.	
CIVIL ENGINEERING.	Colour and Turbidity Removal with Reusable	ENVIRONMENTAL PROTECTION AGENCY,
Effective Wastewater Management Planning for	Magnetic Particles-II. Coagulation with Magnet-	SEATTLE, WA. WATER DIV.
Small Communities - Part 2,	ic Polymer Composites,	Water Quality of the Columbia River,
W81-01083 6E	W81-01141 5F	W81-01200 5

ENVIRONMENTAL PROTECTION SERVICE, OTTAWA (ONTARIO). WATER TRAINING AND

ENVIRONMENTAL PROTECTION SERVICE, OTTAWA (ONTARIO), WATER TRAINING AND TECHNOLOGY TRANSFER DIV. Report of the Urban Drainage Sub-Committee	GEOLOGICAL SURVEY, GARDEN CITY, KS. WATER RESOURCES DIV. Maps Showing Saturated Thickness, January 1979, and Percentage Decrease in Saturated	Geology and Ground Water in North-Central Santa Cruz County, California, W81-01044 7C
Projects Conducted 1972-1978. W81-01019 5D	Thickness, 1950-79, of Unconsolidated Aquifer, West-Central, Kansas,	Development and Use of a Mathematical Model of the San Bernardino Valley Ground-Water Basin, California,
Manual of Practice on Urban Drainage.	W81-01195 7C	W81-01186 2F
W81-01021 10D	GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.	GEOLOGICAL SURVEY, NASHVILLE, TN.
FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE, (ENGLAND). Some Problems of Aquatic Environments in Egypt from a General Viewpoint of Nile Ecol-	Water Resources Data for Pennsylvania, Water Year 1979Volume 1. Delaware River Basin. W81-01042 7C	WATER RESOURCES DIV. Susceptibility of the Memphis Water Supply to Contamination from the Pesticide Waste Disposal Site in Northeastern Hardeman County, Ten-
ogy, W81-01072 5C	GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.	nessee, W81-01192 5B
GEOLOGICAL SURVEY, ALBANY, NY.	Statistical Analyses of Surface-Water-Quality Variables in the Coal Area of Southeastern Mon-	GEOLOGICAL SURVEY, OCALA, FL. WATER
WATER RESOURCES DIV. Ground-Water Appraisal of the Fishkill-Beacon	tana, W81-01023 5B	RESOURCES DIV. Hydrologic Investigations in the Araguaia-To- cantins River Basin (Brazil),
Area, Dutchess County, New York, W81-01028 2F	Water Resources Data for Montana, Water Year	W81-01188 7A
U.S. Geological Survey Activities in New York,	1979. W81-01039 7C	GEOLOGICAL SURVEY OF PUERTO RICO,
1979.	W61-01039	SAN JUAN. WATER RESOURCES DIV. Water Resources Data for Puerto Rico, Water
W81-01183 7A	Geochemistry of Water in the Fort Union For- mation of the Northern Powder River Basin,	Year 1977. Surface and Quality-of-Water Records and Ground Water Records.
GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.	Southeastern Montana, W81-01041 5B	W81-01040 7C
Ground-Water Levels in New Mexico, 1977,		GEOLOGICAL SURVEY, PORTLAND, OR.
W81-01181 7C	GEOLOGICAL SURVEY, HONOLULU, HI. WATER RESOURCES DIV.	WATER RESOURCES DIV. Water Quality of Bear Creek Basin, Jackson
GEOLOGICAL SURVEY, ANCHORAGE, AK. WATER RESOURCES DIV.	Test Monitoring of Prototype Injection Well, Waiale, Maui, Hawaii,	County, Oregon, W81-01032 5A
Water-Resources Reconnaissance of the South- eastern Part of St. Paul Island, Pribilof Islands,	W81-01190 6A	Lakes of Oregon: Volume 6. Douglas County,
Alaska, W81-01033 4A	GEOLOGICAL SURVEY, INDIANAPOLIS, IN. WATER RESOURCES DIV.	W81-01043 2H
	A One-Dimensional, Steady-State, Dissolved-	GEOLOGICAL SURVEY, RALEIGH, NC. WATER RESOURCES DIV.
Reconnaissance Snow Survey of the National Petroleum Reserve in Alaska, April-May 1979, W81-01187- 2C	Oxygen Model and Waste-load Assimilation Study for Little Laughery Creek, Ripley and Franklin Counties, Indiana, W81-01025 5B	Quality of Water in the Black River Near Dunn, North Carolina, and Ground-Water Levels Ad- jacent to the River Prior to Channel Excavation in 1976-79,
GEOLOGICAL SURVEY, AUSTIN, TX.	Water Continue American fields Barton Continue	W81-01193 6A
WATER RESOURCES DIV. Approximate Altitude of Water Levels in Wells in the Chicot and Evangeline Aquifers in the	Water-Quality Assessment of the Porter County Watershed, Kankakee River Basin, Porter County, Indiana,	GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Houston Area, Texas, Spring 1979 and Spring 1980,	W81-01035 5B	An Economic Analysis of Selected Strategies for Dissolved-Oxygen Management: Chattahoochee
W81-01196 2F	GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.	River, Georgia, W81-01036 5B
GEOLOGICAL SURVEY, BOISE, ID. WATER RESOURCES DIV. Sediment Transport in the Snake and Clearwater Rivers in the Vicinity of Lewiston, Idaho,	Water-Resources Investigations of the U.S. Geological Survey in ColoradoFiscal Year 1980. W81-01182	GEOLOGICAL SURVEY, ROLLA, MO. WATER RESOURCES DIV.
W81-01037 2J	Availability and Quality of Groundwater, South- ern Ute Indian Reservation, Southwestern Colo-	Water Resources Data for Missouri, Water Year 1979. W81-01178 7C
GEOLOGICAL SURVEY, CARSON CITY, NV. WATER RESOURCES DIV.	rado, W81-01197 5B	GEOLOGICAL SURVEY, SALT LAKE CITY,
Planning and Design of Studies for River-Qual-		UT. WATER RESOURCES DIV.
ity Assessment in the Truckee and Carson River Basins, California and Nevada,	GEOLOGICAL SURVEY, LAWRENCE, KS. WATER RESOURCES DIV.	Seepage Study of the West Side and West Canals, Box Elder County, Utah,
W81-01024 6A	Simulated Water-Level Declines Near Mar- ienthal, West-Central Kansas,	W81-01026 4A
GEOLOGICAL SURVEY, CHARLESTON, WV. WATER RESOURCES DIV.	W81-01030 4B	GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Water Resources Data for West Virginia, Water Year 1979.	GEOLOGICAL SURVEY, LINCOLN, NE. WATER RESOURCES DIV.	Water Resources Data For Washington, Water Year 1979Volume 1. Western Washington.
W81-01179 7C	A Statistical Analysis of the Quality of Surface Water in Nebraska,	W81-01176 7C
GEOLOGICAL SURVEY, COLUMBUS, OH. WATER RESOURCES DIV.	W81-01180 7C	Water Resources Data for Washington, Water Year 1979Volume 2. Eastern Washington.
Flood of June 18, 1978, on Honey Creek Tribu-	GEOLOGICAL SURVEY, LITTLE ROCK, AR.	W81-01177 7C
tary at Thornville, Ohio, W81-01194 2E	WATER RESOURCES DIV. Water-Quality Investigation of the Caney Creek	GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
GEOLOGICAL SURVEY, DENVER, CO.	Watershed, Northeast Arkansas, W81-01189 6A	Model Evaluation of the Hydrogeology of the Morris Bridge Well Field and Vicinity in West-
WATER RESOURCES DIV. Use of Geophysical Logs to Estimate Water-	GEOLOGICAL SURVEY, MENLO PARK, CA.	Central Florida,
Quality Trends in Carbonate Aquifers, W81-01029 7B	WATER RESOURCES DIV. Sediment Transport of Streams Tributary to San	W81-01027 6A Geologic Aspects of the Surficial Aquifer in the
	Francisco, San Pablo, and Suisun Bays, Califor-	Upper East Coast Planning Area, Southeast
Water Resources of Boulder County, Colorado, W81-01031 5B	nia, 1909-66, W81-01034 2J	Florida, W81-01038 4B

NEW HAMPSHIRE UNIV., DURHAM. DEPT. OF CHEMISTRY.

GEOLOGICAL SURVEY, TOWSON, MD.	ILLINOIS UNIV. AT URBANA-CHAMPAIGN.	MISSOURI UNIVCOLUMBIA, DEPT, OF
WATER RESOURCES DIV.	DEPT. OF CIVIL ENGINEERING.	CHEMISTRY.
Water-Quality Monitoring of Three Major Tri-	Evaluation of Steady-State-Biofilm Kinetics,	Influence of Coal Humic Acid on the Growth of
butaries to the Chesapeake Bay-Interim Data	W81-01125 5A	Chlorella Vulgaris Algae,
Report, W81-01184 7C	ILLINOIS UNIV., URBANA-CHAMPAIGN.	W81-01009 5C
W01-01104	DEPT. OF AGRICULTURAL ENGINEERING.	MONTANA STATE UNIV., BOZEMAN.
GEOLOGICAL SURVEY, TRENTON, NJ.	Costs and Benefits of Terraces for Erosion Con-	Wastewater Treatment Process Evaluated by
WATER RESOURCES DIV.	trol,	Force Account,
Digital-Simulation and Projection of Head Changes in the Potomac-Raritan-Magothy	W81-01062 4D	W81-01086 6B
Aquifer System, Coastal Plain, New Jersey,	IMPERIAL COLL, OF SCIENCE AND	
W81-01185 2F	TECHNOLOGY, LONDON (ENGLAND).	NAPLES UNIV. (ITALY), FACOLTA DI
	DEPT. OF PUBLIC HEALTH ENGINEERING.	INGEGNERIA. Ultrafiltration Processes for Pollution Control
GEOLOGICAL SURVEY, TUCSON, AZ. WATER RESOURCES DIV.	Response to Comments by A. P. Walker, W. F.	and Chemical Reuse in the Tanning Industry,
Simulated Effects of a Proposed Well Field on	Holman and R. H. Wendt,	W81-01139 5D
the Groundwater System in the Salt River	W81-01147 5D	
Indian Reservation, Maricopa County, Arizona,	INSPECTEUR GENERAL DES SERVICES	NAPLES UNIV. (ITALY). IST. DI PRINCIPI
W81-01191 2F	TECHNIQUES, MARSEILLE (FRANCE).	DI INGEGNERIA CHIMICA. Effect of Alcohols on the Mechanical and
GEORGIA INST. OF TECH., ATLANTA.	Conception of Plans for a Marseille Purifying	Transport Properties of Asymmetric Cellulose
SCHOOL OF GEOPHYSICAL SCIENCES.	Facility. (Conception du Projet de la Station	Acetate Membranes,
Chemical and Spectroscopic Characterization of	d'Epuration de Marseille), W81-01078 5D	W81-01148 5D
Humic Substances Derived from River Swamps in the Flood Plains of Southeastern U.S. Coastal	W81-010/8	NATIONAL BUREAU OF STANDARDS
Streams,	INSTITUT RUDJER BOSKOVIC, ZAGREB	NATIONAL BUREAU OF STANDARDS, WASHINGTON, DC. NATIONAL
W81-01158 5A	(YUGOSLAVIA).	MEASUREMENT LAB.
	Trace Elements in Water and Biological Sam-	Determination of the Aqueous Solubilities of
GIESSEN UNIV. (GERMANY, F.R.).	ples Determined by X-Ray Spectroscopy,	Organic Liquids at 10.0, 20.0, and 30.0 C by
PHYSIKALISCHES INST. Analysis of Thermal Impact in Tidal Rivers and	W81-01077 5A	Elution Chromatography,
Estuaries,	INSTITUTE OF HYDROLOGY,	W81-01127 5A
W81-01142 5C	WALLINGFORD (ENGLAND).	NATIONAL HYDROLOGY RESEARCH INST.,
COMPANDA CANADA	Aerial Infrared Photography for Flood Plain	CALGARY (ALBERTA).
GOETEBORG UNIV. (SWEDEN). DEPT. OF ZOOLOGY.	Investigations,	Program Layout - An Interactive Program to
Predator-Prey Relations Important for the	W81-01055 7B	Handle Page Layout for Documentation of
Biotic Changes in Acidified Lakes,	INSTITUTE OF OCEAN SCIENCES, SIDNEY	Computer Files Printed on-Line at Remote Ter-
W81-01129 5C	(BRITISH COLUMBIA), OCEAN ECOLOGY	minals, W81-01015 7B
GRIFFITH UNIV., NATHAN (AUSTRALIA).	LAB.	W 61-01013
SCHOOL OF AUSTRALIAN	Taxonomy, Pollution and Sludge Worm,	NATIONAL HYDROLOGY RESEARCH INST.,
ENVIRONMENTAL STUDIES.	W81-01117 5A	OTTAWA (ONTARIO).
Third-Order Integral Relation Between Sorpti-	KIEL UNIV. (GERMANY, F.R.). INST. FUER	Programs Revap and Wevap for Estimating
vity and Soil Water Diffusivity Using Brutsaert's Technique,	MEERESKUNDE.	Areal Evapotranspiration and Lake Evaporation
W81-01076 2G	In-Situ Registration of Oxygen Utilization at	From Climatological Observations, W81-01017 2D
	Sediment-Water Interfaces,	W01-01017
GULF SOUTH RESEARCH INST., NEW	W81-01054 2K	NATIONAL WATER RESEARCH INST.
ORLEANS, LA. DEPT. OF POLYMER.	LAURENTIAN UNIV., SUDBURY (ONTARIO).	BURLINGTON (ONTARIO).
Development of Novel Porous Substrates for Ultrafiltration, Desalination, and Water Recla-	DEPT. OF BIOLOGY.	Enhancement of PCBS Biodegradation by
mation,	Psychrophiles, Psychrotrophs, and Mesophiles	Sodium Ligninsulfonate, W81-01133 5D
W81-01001 3A	in an Environment which Experiences Seasonal	W81-01133
HACCARD TOUGHTH AND BRAIN	Temperature Fluctuations, W81-01124 5A	NEBRASKA UNIVLINCOLN. CENTER FOR
HAGGARD, TOUSLEY AND BRAIN, SEATTLE, WA.	W61-01124 JA	AGRICULTURAL METEOROLOGY AND
The Columbia River: Protein, Power, Preserva-	LEAGUE OF WOMEN VOTERS,	CLIMATOLOGY.
tion, and Politics,	ROCHESTER, NY.	Remotely Sensed Crop Temperature for Water
W81-01198 6D	Land Use. Pigs in Pokes: Pork Barrel Water	Resources Management, W81-01002 7B
HAZEN AND SAWYER, HOLLYWOOD, FL.	Projects, W81-01063 5C	W81-01002
Hydraulic Efficiency of Wastewater Lagoon	W 81-01003	NEBRASKA UNIVLINCOLN. DEPT. OF
Systems,	MANHATTAN COLL., BRONX, NY. DEPT. OF	AGRICULTURAL ECONOMICS.
W81-01093 5D	CIVIL ENGINEERING.	An Economic Evaluation of the Feasibility of
HOLLOWAY (MAX) ENGINEERING CO.,	The Effect of Concentration of Adsorbing	Artificial GroundWater Recharge in Nebraska W81-01155
MUSKOGEE, OK.	Solids on the Partition Coefficient, W81-01144 5B	W81-01155 6E
Flow Equalize All Influent,	W81-01144 5B	NEVADA HISTORICAL SOCIETY, RENO.
W81-01119 5D	MARYLAND UNIV., COLLEGE PARK, DEPT.	The Orr Ditch Case, 1913-1944,
HYDROTECHNIC CORP., NEW YORK.	OF CIVIL ENGINEERING.	W81-01161 6E
New Concepts for the Treatment of Sewage	Storage-Induced Denitrification Using Sequenc-	Th. T I D Fish 1944 1944
Discharged to the Sea,	ing Batch Reactor Operation,	The Truckee Basin Fishery, 1844-1944, W81-01162 50
W81-01080 5D	W81-01132 5D	W 01-01102
HAINOIC ENTARONMENTAL BROTECTION	MASSACHUSETTS INST. OF TECH.,	NEVADA UNIV., RENO. DIV. OF
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY, SPRINGFIELD.	CAMBRIDGE, DEPT. OF MECHANICAL	BIOCHEMISTRY.
Efficiencies of Liquid-Liquid Extraction and	ENGINEERING.	Photolysis of 3,4-Dichloroaniline in Natura
XAD-4 and XAD-7 Resins in Collecting Organ-	The Thermal Sensitivity of Nitrification as a	Waters, W81-01101 5A
ic Compounds from a Coke Plant's Effluent,	Function of the Concentration of Nitrogen Sub-	W 01-01101
W81-01112 5A	strate, W81-01145 5D	NEW HAMPSHIRE UNIV., DURHAM, DEPT.
ILLINOIS UNIV. AT URBANA-CHAMPAIGN.		OF CHEMISTRY.
DEPT. OF BOTANY.	MELBOURNE UNIV., PARKVILLE,	Differential Pulse Anodic Stripping Voltam
Comparative Resistance of the Soil and the Plant	(AUSTRALIA), MARINE CHEMISTRY LAB.	metry of Copper(II) at the Glassy Carbon Elec
to Water Transport, W81-01082 2G	Behaviour of Phosphate in Estuarine Water, W81-01050 5B	trode, W81-01010 5/

5A

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRONOMY.

NEW MEXICO STATE UNIV., LAS CRUCES.	OREGON STATE UNIV., CORVALLIS, DEPT.	RIJKSINSTITUUT VOOR
DEPT, OF AGRONOMY,	OF CIVIL ENGINEERING.	DRINKWATERVOORZIENING,
Using Saline Water for Crop Production in New	Kinetics of Trace Metal Partitioning in Model	LEIDSCHENDAM (NETHERLANDS).
Mexico,	Anoxic Marine Sediments,	Corrosiveness of Drinking Water and Cardio-
W81-01156 3C	W81-01154 5B	vascular Disease Mortality, W81-01109 5F
NORTH CAROLINA CTATE UNITY AT	OREGON STATE UNIV., CORVALLIS. DEPT.	W81-01109 5F
NORTH CAROLINA STATE UNIV., AT	OF GEOGRAPHY.	RJN ENVIRONMENTAL ASSOCIATES, INC.,
RALEIGH. Wastewater Characterization in a Multiproduct	International Management of the Columbia,	WHEATON, IL.
Dairy,	W81-01201 6E	New Ways to Fix Leaky Sewers,
W81-01170 5F		W81-01102 8A
	OSLO UNIV. (NORWAY).	
NORTH CAROLINA UNIV. AT CHAPEL	Effects of Heavy Metals in Combination with	ROHM AND HAAS CO., BRISTOL, PA.
HILL.	NTA, Humic Acid, and Suspended Sediment on	ENGINEERING DIV. Design and Specifications of a 500 Gallon Per
Philosophy of the Safe Drinking Water Act and	Natural Phytoplankton Photosynthesis, W81-01108 5C	Day Secondary Refrigerant Freeze Concentra-
Potable Reuse,	W81-01106	tion Pilot Plant to Treat Aqueous-Organic In-
W81-01120 5D	PACIFIC NORTHWEST RIVER BASINS	dustrial Streams, Phase 1,
NORTH CAROLINA UNIV. AT CHAPEL	COMMISSION, VANCOUVER, WA.	W81-01006 5D
HILL, DEPT. OF ENVIRONMENTAL	Concern Over the Columbia Estuary,	
SCIENCES AND ENGINEERING.	W81-01011 6E	ROME UNIV. (ITALY). IST. DI CHIMICA
Packed Bed Filtration: Experimental Investiga-		ANALITICA.
tion and Conceptual Analysis of Filter Ripening	PENNSYLVANIA STATE UNIV.,	Concentration and Determination of Polycyclic
Model,	UNIVERSITY, PA. INST. FOR RESEARCH	Aromatic Hydrocarbons in Aqueous Samples on Graphitized Carbon Black,
W81-01168 5D	ON LAND AND WATER RESOURCES. Fiscal 1980 Annual Report to Office of Water	W81-01068 5A
	Research and Technology, USDI.	7A
Interactions and Survival of Enteric Viruses in	W81-01004 6E	RUTGERS - THE STATE UNIV., NEW
Soil Materials,	0.00	BRUNSWICK, NJ. CENTER FOR COASTAL
W81-01171 5B	PIERSON AND COMPANY, MANCHESTER	AND ENVIRONMENTAL STUDIES.
NORTH CENTRAL FOREST EVERBIATENT	(ENGLAND).	Coincidence of Cadmium and Antibiotic Resist-
NORTH CENTRAL FOREST EXPERIMENT STATION, RHINELANDER, WI.	Sludge Dewatering,	ance in New York Bight Apex Benthic Microor-
Irrigation of Intensively Cultured Plantations	W81-01071 5D	ganisms,
with Paper Mill Effluent,	POITIERS UNIV. (FRANCE). LAB. DE	W81-01116 5B
W81-01094 3C	CHIMIE XI.	RUTGERS - THE STATE UNIV., NEW
	Experimental Assessment of Haloform Reaction	BRUNSWICK, NJ. WATER RESOURCES
NORTH DAKOTA STATE UNIV., FARGO.	Precursors (Etude d'une Methode d'Evaluation	RESEARCH INST.
DEPT. OF CIVIL ENGINEERING.	Globale des Precurseurs de la Reaction Halo-	Input into and Fate of Lead in a Small Reser-
Efficient Design of Stormwater Holding Basins	forme),	voir,
Used for Water Quality Protection,	W81-01151 5D	W81-01045 5B
W81-01136 5G	DATE	W 1 W B B 1 1 B
NORTHUMBERLAND COLL. OF	POLLUTECH POLLUTION ADVISORY	Five-Year Water Resources Research and De- velopment Plan, Fiscal Years 1982-1986.
EDUCATION, NEWCASTLE-UPON-TYNE	SERVICES LTD., OAKVILLE (ONTARIO). Chemical Dosage Control for Phosphorus Re-	W81-01160 6E
(ENGLAND), DEPT. OF ENVIRONMENTAL	moval.	W 01-01100
SCIENCE.	W81-01018 5D	SCIENCE AND EDUCATION
Changes in Nutrient Ion Level of Substrates and		ADMINISTRATION, BELTSVILLE, MD.
Stream Water Due to Land Management in	Pilot Scale Evaluation of Physical-Chemical	BIOLOGICAL WASTE MANAGEMENT AND
Northumberland,	Wastewater Treatment System for Combined	ORGANIC RESOURCES LAB.
W81-01046 5C	Sewer Overflows.	Metal Uptake by Crops Grown Over En-
OHIO CTATE UNITY COLUMNIC DEPT OF	W81-01020 8B	trenched Sewage Sludge, W81-01100 5E
OHIO STATE UNIV., COLUMBUS. DEPT. OF MICROBIOLOGY.	PRINCETON UNIV., NJ. DEPT. OF CIVIL	W81-01100
Translocation of Mercury and Microbial Adap-	ENGINEERING.	SCIENCE AND EDUCATION
tation in a Model Aquatic System,	Saturated-Unsaturated Flow in Radial Direc-	ADMINISTRATION, RIVERSIDE, CA.
W81-01174 5B	tions Generated by an Injection Well,	SALINITY LAB.
	W81-01091 2G	A Closed-Form Equation for Predicting the Hy-
OHIO STATE UNIV., COLUMBUS. WATER		draulic Conductivity of Unsaturated Soils,
RESOURCES CENTER.	PROCTOR AND GAMBLE LTD.,	W81-01087 2G
Five-Year Water Resources Research and De-	NEWCASTLE-UPON-TYNE (ENGLAND). Comment.	SIMON FRASER UNIV., BURNABY (BRITISH
velopment Plan, Fiscal Years 1982-1986,	W81-01146 5D	COLUMBIA), DEPT. OF CHEMISTRY.
W81-01164 6E		Mussels (Mytilus Edulis) as 'Point Source' Indi-
OKAYAMA UNIV. (JAPAN), DEPT, OF	PURDUE UNIV., LAFAYETTE, IN.	cators of Trace Metal Pollution,
PUBLIC HYGIENE.	AGRICULTURAL EXPERIMENTAL STATION.	W81-01115 5A
Gas Chromatography Combined with Mass	Algal Availability of Sediment Phosphorus in	
Spectrometry for the Identification of Organic	Drainage Water of the Black Creek Watershed,	STONE AND WEBSTER ENGINEERING
Sulfur Compounds in Shellfish and Fish,	W81-01058 5B	CORP., BOSTON, MA. HYDROLOGY DIV.
W81-01123 5C	PURDUE UNIV., LAFAYETTE. SCHOOL OF	Offshore Water Intakes Designed to Protect Fish,
	CIVIL ENGINEERING.	W81-01070 6G
OREGON DEPARTMENT OF FISH AND	Modeling the Runoff Process in Urban Areas,	
WILDLIFE, PORTLAND.	W81-01153 2A	SWEDISH FOREST PRODUCTS RESEARCH
Fish Management and Protection,		LAB. STOCKHOLM. DEPT. OF CHEMISTRY.
W81-01012 81	RAJA BALWANT SINGH COLL., AGRA	Utilization of the White-Rot Fungus Sporotri-
OREGON STATE UNIV., CORVALLIS, DEPT.	(INDIA), DEPT. OF AGRICULTURAL	chum Pulverulentum for Water Purification and
OF AGRICULTURAL AND RESOURCE	CHEMISTRY.	Protein Production on Mixed Lignocellulosic
ECONOMICS.	Effect of the Salinity of Irrigation Water on Wheat Yield and Soil Properties,	Wastewaters, W81-01126 5D
Agriculture and Hydro-Power: Costs, Benefits,	W81-01114 3C	W 01-01120 3L
and Trade-Offs,	30	SYRACUSE UNIV., NY. DEPT. OF CIVIL
W81-01199 6B	RHODE ISLAND UNIV., KINGSTON. DEPT.	ENGINEERING.
	OF PLANT AND SOIL SCIENCE.	Changes in the Zooplankton of Onondaga Lake
Navigation as an Alternative Use,	A Variable-Depth Ground-Water Sampler,	(NY), 1969-1978,
W81-01202 6B	W81-01088 5A	W81-01122 5C

	WYOMING UNIV., LARAMIE. DEPT. OF BOTANY
TECHNICAL UNIV. OF DENMARK, LYNGBY. DEPT. OF SANITARY ENGINEERING.	WATER SPACE AMENITY COMMISSION, LONDON (ENGLAND).
Residence Time Distribution in Submerged Bio- filters,	Conservation V. Land Drainage - A Guide for the Future,
W81-01140 5D	W81-01048 6A
TECHNISCHE UNIV., BERLIN (GERMANY, F.R.). Sand Cambisol Functioning as a Filter through	WESTINGHOUSE RESEARCH AND DEVELOPMENT CENTER, PITTSBURGH,
Long-Term Irrigation with Wastewater, W81-01130 5D	PA. Boron Recovery by Reverse Osmosis, W81-01056 5D
TEXAS A AND M UNIV. RESEARCH CENTER, EL PASO.	WISCONSIN UNIVMADISON. Sewage: Waste or Resource,
Effects of Bicarbonate on Sodium Hazard of Irrigation Water: Alternative Formulation, W81-01089 2G	W81-01064 5D WISCONSIN UNIV., MADISON, DEPT. OF
	SOIL SCIENCE,
THAMES WATER AUTHORITY, LONDON (ENGLAND). Rehabilitation of the Inner Thames Estuary, W81-01118 5C	Comparison of One-Step Outflow Laboratory Method to an in Situ Method for Measuring Hydraulic Conductivity, W81-01092 2G
TOWILL (R. M.) CORP., HONG LULU, HI. Advanced Primary Treatment for Ocean Dis-	WISCONSIN UNIV., MADISON. LAB. OF HYGIENE.
charge, W81-01079 5D	Sediment Oxygen Demand Techniques: A Review and Comparison of Laboratory and in
TRONDHEIM UNIV. (NORWAY). DEPT. OF	Situ Systems, W81-01149 5A
CHEMISTRY. Determinations of Trace Amounts of 9,10-Anth-	WISCONSIN UNIVMADISON, WATER
raquinone in Aqueous Systems by Differential	RESOURCES CENTER.
Pulse Polarography, W81-01106 5A	Water Problems and Research Needs for Wis- consin, A 5-Year Plan,
UNIVERSITY OF STRATHCLYDE, GLASGOW	W81-01159 6E
(SCOTLAND). DEPT. OF APPLIED PHYSICS. A Correlation Method for the Estimation of Retention Times at Full-Scale Sewage Treat-	BOTANT.
ment Plants, W81-01150 5D	Water Movement Through Stands of Lodgepole Pine Forest in Wyoming,
	W81-01175 2D
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA), DEPT. OF CHEMICAL ENGINEERING, Treatment of Dilute Metal Effluents in an Elec-	
trolytic Precipitator,	
W81-01172 5D	
UNIVERSITY OF WALES INST. OF SCIENCE AND TECHNOLOGY, CARDIFF. DEPT. OF APPLIED BIOLOGY.	
The Aquatic Vegetation of Llangorse Lake, Wales.	
W81-01131 5C	
UOP, INC., SAN DIEGO, CA. FLUID SYSTEMS DIV.	
Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater	
Desalination, W81-01166 3A	
Research and Development on a Spiral-Wound Membrane System for Single-Stage Seawater	
Deslination, W81-01167 3A	
VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF BIOLOGY. Asiatic Clam Invasion: Causes and Effects,	
W81-01173 5C	
VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.	
Activated Sludge Wastewater TreatmentStoi- chiometric Relationships.	
W81-01105 5D	

WASHINGTON UNIV., SEATTLE, DEPT. OF ENVIRONMENTAL HEALTH. Electron Microscopy of Giardia Lamblia Cysts, W81-01059 5F

W81-01085 W81_01086 6B W81-01087 2G 5A W81-01088 W81-01090 3C 2G 2G W81-01091 W81-01092 W81-01093 5D W81-01094 W81-01095 5D W81-01096 5D W81_01097 5D W81-01098 6E W81-01099 SA W81-01100 W81-01101 5A W81-01102 W81-01103 5A W81-01104 60 5D W81-01105 W81-01106 W81-01107 5D W81-01108 5C 5F W81-01109 W81-01110 5B W81-01111 W81-01112 5A W81-01113 W81-01114 3C W81-01115 5A W81-01116 5B W81-01117 W81-01118 W81-01119 W81-01120 5D 5D W81-01121 5B W81-01122 5C W81-01123 5C W81-01124 W81-01125 SA W81-01126 5D W81-01127 W81-01128 2H W81-01129 W81-01130 5D W81-01131 5C W81-01132 5D W81-01133 5D W81-01134 W81-01135 5B W81-01136 W81-01137 5B W81-01138 W81-01139 5D W81-01140 5D W81-01141 5F W81-01142 W81-01143 5F W81-01144 5B W81-01145 5D W81-01146 5D W81-01147 W81-01148 W81-01149 5A W81-01150 W81-01151 5D 5D W81-01152 5D W81-01153 W81-01154 5B W81-01155 W81-01156 3C W81-01157 5C W81-01158 5A W81-01159 W81-01160 W81-01161 W81-01162 5C W81-01163 6E W81-01164 6E W81-01165 3A W81-01166 3A W81-01167 W81-01168

W81-01169 W81-01170 5F W81-01171 SB W81-01172 5D 5C W81-01173 W81-01174 5B W81-01175 W81-01176 7C W81-01177 7C W81-01178 7C W81-01179 W81-01180 70 W81-01181 W81-01182 W81-01183 70 W81-01184 W81-01185 2F W81-01186 2F W81-01187 W81-01188 W81-01189 W81-01190 W81-01191 W81-01192 2F 5B W81-01193 6A W81-01194 2E W81-01195 W81-01196 W81-01197 SB W81-01198 6D W81-01199 6R W81-01200 5C W81-01201 6E W81-01202 W81-01203

W81-01083

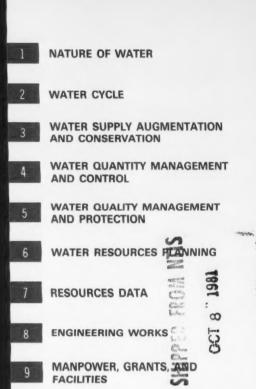
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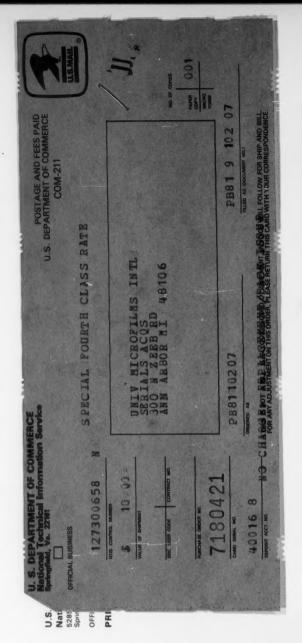
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INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

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